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PHYSICS ABSTRACTS

SECTION A

of

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SECTION B, ELECTRICAL ENGINEERING

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NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers. (An abridged version of the U.D.C. accompanies the Annual Index.) An abstract of interest under more than one head has additional U.D.C. numbers, linked by the colon sign, " : " e.g. " 536.21 : 548.0 Conduction of heat in crystals." The Abstract is printed once only, under the main number, e.g. in the section "HEAT 536," but Cross-references are inserted under the other numbers, e.g. " 548.0 : 536.21 *see Abstr.* 1234 " in the section " CRYSTALLOGRAPHY 548." These Cross-references should be investigated, therefore, when a particular section is being searched, as they contain additional matter relevant to that section. A Cross-reference does *not* refer to the Abstract which appears immediately above it.

Abstracts signed with the following initials have been supplied by the courtesy of the organizations named: "B.A." = British Abstracts. "E.R.A." = British Electrical and Allied Industries Research Association. "M.A." = Metallurgical Abstracts. " M.R." = Mathematical Reviews. " M.-V." = Metropolitan-Vickers Electrical Co., Ltd. " P.O." = Post Office Engineering Department. "R.E.A." = Railway Engineering Abstracts.

MATHEMATICS 51

511.223 2432

Bernoulli's numbers and certain arithmetic quotient functions. VANDIVER, H. S. *Proc. Nat. Acad. Sci., Wash.*, **31**, 310–14 (*Sept.*, 1945).—A congruence involving Bernoulli numbers, established in a previous paper [Abstr. 1604 (1945)], is now extended to the generalized Bernoulli numbers of the first order. L. S. G.

512.25 = 4 2433

On a system of linear equations. PERSSON, K. *Ark. Mat. Astr. Fys.*, **32 A** (*No.* 3) *Paper* 12, 8 *pp.* (1945) *In French.*—Properties of $\Gamma(z)$ (z is complex) are used to prove the following: the equations

$$\sum_{q=1}^{\infty} \frac{x_q}{p-q-\lambda} = 0 \qquad p = 1, 2, \ldots$$

where λ is a non-integral complex number, possess only the trivial solution $x_i = 0$ $(i = 1, 2, \ldots)$ for $R(\lambda) \geqslant 0$; if $R(\lambda) < 0$ there are $(r+1)$ linearly independent solutions, where r is the integral part of $-R(\lambda)$, unless $R(\lambda)$ is integral, when there are r solutions. The general solution is of the form

$$x_q = \binom{\lambda+q-1}{q-1}[c_0 + c_1(\lambda+q) + \ldots + c_s(\lambda+q)^s]$$

where $q = 1, 2, \ldots$ and the c_ν are constants. L. S. G.

512.3 = 4 2434

On the existence of solutions of certain iterated equations. KREWERAS, G. *C.R. Acad. Sci., Paris*, **219**, 303–5 (*Sept.* 25, 1944) *In French.*—A solution of $y_{n+1} = ax + by_n + f(x, y_n)$, with $|a| = \alpha$, $|b| = \beta$, is sought in the form

$$y = \phi(x) = \sum_{i=0}^{\infty} \pi_i x^i.$$

It is shown that (1) if $4\alpha\beta < 1$, there is at least one function $\phi(x)$, (2) if $\alpha + \beta < 1$ there exist two and only two functions $\phi(x)$, (3) if $4\alpha\beta > 1$ there is no solution. L. S. G.

512.831 2435

The inverse of a stiffness matrix. BISSHOPP, K. E. *Quart. Appl. Math.*, **3**, 82–4 (*April*, 1945).—It is shown that the inverse of a special type of stiffness matrix may be written in a form suitable for rapid numerical evaluation. An example is given, the matrix being of order 4. L. S. G.

517.54 : 533.6.011.31 2436

On Theodorsen's method of conformal mapping of nearly circular regions. WARSCHAWSKI, S. E. *Quart. Appl. Math.*, **3**, 12–28 (*April*, 1945).—Theodorsen gave a method for mapping the exterior of a circle conformally on to that of a "nearly circular" contour, the mapping function being given as the solution of a non-integral equation which was solved by a process of successive approximation. The validity of the method and the convergence of the approximating process are discussed in the present paper. Simple conditions on the nearly circular contour are established which ensure the convergence. The absolute value of the difference between the mapping function and the successive approximations is estimated, and this is used in proving the convergence and in examining the accuracy of the approximation. Conditions are discussed under which the map of the circle by the successive approximations is star shaped. Some auxiliary results, such as the uniqueness of the solution of Theodorsen's integral equation, are obtained in the last section. Theodorsen's method is of importance in the theory of airfoils, e.g. in determining the complex velocity potential of the two-dimensional flow around an airfoil. L. S. G.

517.9 : 534.014.2 = 4 *see Abstr.* 2525

517.941.9 = 82 2437

New method of solving some boundary problems in equations in mathematical physics, where separation of variables is permissible. GRINBERG, G. A. *Bull. Acad. Sci., USSR, Sér. Phys.*, **10** (*No.* 2) 127–68 (1946) *In Russian.*

518.3 2438

Nomograph for formulas containing fractional exponents. BURROWS, W. H. *Industr. Engng Chem.*, **38**, 586–9 (*Jan.*, 1946).—A new nomograph has been derived which accomplishes the simultaneous involution of terms to fractional powers and multiplication or division of several such terms. The method is illustrated by the solution of typical problems.

518.5 : 519.2 2439

Slide-disk calculator. MERRILL, G. S. *Gen. Elect. Rev.*, **49**, 30–3 (*June*, 1946).—A simple instrument is described for use in calculating various statistical quantities, e.g. root mean square, standard deviation, correlation coefficients. L. S. G.

519 : 55 2440

On convergence in length. AYER, M. C. *Proc. Nat. Acad. Sci., Wash.*, **31**, 261–6 (*Aug.*, 1945).—Various results are obtained in the theory of arc length. Convergence in length is studied in the parametric and non-parametric cases and the gap between these two cases is narrowed. L. S. G.

519.2 : 518.5 *see Abstr.* 2439

519.213 : 53.088.3 2441

An extension of Campbell's theorem of random fluctuations. RIVLIN, R. S. *Phil. Mag.*, **36**, 688–93 (*Oct.*, 1945).—The theorem states that if, at an instant t, the response y of a linear instrument to a single event occurring at time τ is given by $y = s(t-\tau)$ then the mean square deviation of the response to a large number of such events, occurring at random in time, is given by $\overline{(y-\bar{y})^2} = \lambda\int_0^\infty s^2(t)dt$ where λ is a constant. The extension now made consists in evaluating explicitly the value of $\overline{(y-\bar{y})^p}$ for $p = 3, 4, 5, \ldots$ when (1) all the events are identical but occur at random in time, or (2) the events are of N different types, which occur in an unrelated manner, each type occurring at random in time. L. S. G.

519.27 = 4 2442

On the rectangular distribution and the Bernoulli numbers. FÉRAND, L. *C.R. Soc. Phys. Hist. Nat. Genève*, **62** (*No.* 2) 71–5 (*April–July*, 1945) *In French.*—The moments and semi-invariants of the distribution are written down. The latter involve Bernoulli numbers, B_i. The relations between the moments and the semi-invariants lead to relations between the B_i and the sequence $1/2, 1/3, \ldots 1/(1+k)$. The distribution obtained by compounding n rectangular distributions is studied briefly. L. S. G.

522.2 2443

A large astronomical telescope for Great Britain. *Nature, Lond.*, **158**, 220–2 (*Aug.* 17, 1946).—A report of a discussion held by the Royal Astronomical Society, June 14, 1946.

523.11 : 531.51 2444

The mass of the universe. WHITROW, G. J. *Nature, Lond.*, **158**, 165–6 (*Aug.* 3, 1946).—The gravitational energy of a sphere of mass M and radius R is given under classical mechanics by $V = 3GM^2/5R$, and the inertial energy by Einstein's theory is $E = Mc^2$. If we set $V = E$ we obtain $M = kc^2R/G$, where $k = 1{\cdot}67$. This approximates to the formula connecting mass and radius of the Einstein universe, and to Milne's formula $M = c^3t/G$ if $R = ct$. In all three cases M is of the order of 10^{55} gm which gives a density of the order of $10^{-27} - 10^{-29}$ gm/cm^3, in agreement with Hubble, if $R \simeq 2\times10^9$ light years.

523.165 : 621.396.821 2445

Fluctuations in cosmic radiation at radio-frequencies. HEY, J. S., PARSONS, S. J., AND PHILLIPS, J. W. *Nature, Lond.*, **158**, 234 (*Aug.* 17, 1946).—The radiation associated with the direction of Cygnus [Abstr. 1205 (1946)] has been found to exhibit short-period irregular fluctuations of average amplitude of 15% of the mean power received. The parallel with r.f. radiations from sun-spots is pointed out [see Abstr. 2017 (1946)].

523.2 : 523.4 = 3 2446

The origin, structure, energy and age of stars and their planets. GASSER, A. *Helv. Phys. Acta*, **18** (No. 3) 226–30 (1945) *In German.*—A nebular theory of solar systems is given in summary form. The rotation of the perihelion of Mercury is explained by a planet at 2×10^{17} cm from the sun, the sun's original radius. The sun is supposed to be an Emden polytrope of index 3, with a core of density 10^{13}–10^{14} g/cm^3 in which electrostatic fields are important; increase in this core liberates enough gravitational energy to supply the sun's radiation. Bode's law is explained.

T. G. C.

523.32 : 535.232 : 621.396.821 : 523.72 *see Abstr.* 2449

523.4 = 3 2447

The condensation of gas spheres. BAUMGARTNER, W. *Helv. Phys. Acta*, **18** (*No.* 3) 168–94 (1945) *In German.*—A polytropic gas sphere is shown to be unable to begin condensing at its centre if its mass is as large as that of a planet. Condensation forming planets is assumed to begin at the boundary of a gas sphere, falling drops cooling the interior until the whole forms a "wet" cloud; a liquid core then grows. Condensation of this type is shown to form a planet of mass $\sim4\times10^{29}$ g or less when the sun's disturbing influence is appreciable. T. G. C.

523.4 : 523.2 = 3 *see Abstr.* 2446

523.46/.47 = 4 2448

On a new method for measuring the diameters of the satellites of Jupiter and Saturn. CARMICHEL, M. *C.R. Acad. Sci., Paris*, **219**, 21–2 (*July* 3, 1944) *In French.*—A short description is given of the optical system which has been used to measure the diameters of the 4 principal satellites of Jupiter and of the great satellite of Saturn. Results of measurements made in 1944 are recorded and compared with those of earlier observers. L. S. G.

523.72 : 523.32 : 535.232 : 621.396.821 2449

Microwave radiation from the sun and moon. DICKE, R. H., AND BERINGER, R. *Astrophys. J.*, **103**, 375–6 (*May*, 1946).—A radiometer provided with an 18 in parabolic-reflector aerial of gain 6 000 was used to measure the sun's electromagnetic radiation at a wavelength of 1·25 cm during the partial eclipse of July 9, 1945. The observed intensities fit well with those obtained by assuming the sun in this radio region to be a uniform disc of optical size at 10 000°K. Similar measurements on the nearly full moon give an effective temperature of 292°K. A. HU.

523.72 : 551.521 2450

Microwave radiation from the sun. SOUTHWORTH, G. C. *J. Franklin Inst.*, **239**, 285–97 (*April*, 1945). *Errata*, 241 (*March*, 1946).—A double detection receiver designed to work at centimetric wavelengths is used with an aerial at the focus of a parabolic mirror mounted in altazimuth fashion. Observations of the sun's radiation at 1¼ cm, 3 cm and 10 cm over a Mc band at each frequency give emissions respectively 0·3, 2·1 and 2·9× the black-body values for 6 000°K. No diurnal variation was observed. The radiation varied at sunrise and sunset in a way consistent with the geometrical conditions, though the transitions were prolonged at the shortest wavelength. Comparison of the patterns obtained by letting first the sun's disc and then a local point source move across the mirror aperture suggests that the angle of arrival of the solar radiation varies rapidly over a considerable range, i.e. the sun shimmers in the radio region of the spectrum, possibly owing to refraction anomalies. No radiation is found from the Milky Way or from other celestial objects. A. HU.

523.746 : 551.524.33 *see Abstr.* 2706

523.752 2451

A theory of chromospheric flares. GIOVANELLI, R. G. *Nature, Lond.*, **158**, 81–2 (*July* 20, 1946).—A mechanism is proposed based on the energies acquired by charged particles moving in induced electric fields associated with sunspots. The growth of the magnetic field of the sunspot will cause an induced electric field at right angles to it and the conditions for electron acceleration to hydrogen excitation energies by these fields are worked out. It is shown that circumstances favourable to this excitation require neutral points in the magnetic field, which may be caused by other sunspots or a general solar magnetism. The conclusion, based on certain assumptions of chromosphere conductivity, is that the theory is able to explain localized regions of increased radiation in general conformity with observation.

523.755 2452

A physical theory of the solar corona. SAHA, M. N. *Proc. Phys. Soc., Lond.*, **57**, 271–86 (*July*, 1945).—The high-excitation lines of He and He$^+$ observed in the chromosphere are ascribed to cascade emissions as α-particles, produced by nuclear reactions, capture electrons. The highly stripped metal atoms

which, according to Edlén, produce coronium lines are suggested to be products of ternary nuclear fission, and coronal electrons are electrons knocked from atoms in the reversing layer and chromosphere by these products of fission. [See Abstr. 464 (1945)].

T. G. C.

523.755 : 550.385 2453

The correlation of magnetic disturbances with intense emission regions of the solar corona. SHAPLEY, A. H., AND ROBERTS, W. O. *Astrophys. J.*, **103**, 257–74 (*May*, 1946).—Magnetic disturbances are found to occur frequently one or two days before bright coronal emission regions (λ5303 Å) reach the centre of the sun's disc. Though valid criticisms may be made of the methods of correlation used, the correlation is certainly real, and valuable for short-term forecasts of disturbance. Evidence is advanced that coronal emission regions may be identical with *M*-regions. Earlier results have suggested that magnetic disturbances come one day after the disturbing solar region reaches the central meridian; possible explanations of the discrepancy between these and the present results are discussed. In an appendix, the procedure for coronal observations is detailed.

T. G. C.

523.774 2454

Chemical compounds in the sun. BABCOCK, H. D. *Astrophys. J.*, **102**, 154–67 (*Sept.*, 1945).—Over 100 spectrograms of the solar disc and sunspots in the region 3 000–11 500 Å, taken on the 150-ft Pasadena reflector in various orders of a 21-ft concave grating, are used to identify 18 compounds by comparing with laboratory data. The criteria used are mainly qualitative and physical. Observed vibrational transitions are summarized and a finding list given. The molecules NH and probably MgH appear in electronically excited states. The red system of CN is weak but appears in spot and disc spectra. New compounds found include BH, MgF, SrF, YO, ScO, MgO and O_2, but 14 others previously reported are not confirmed. Improved agreement is achieved between abundance estimated from the appearance of bands and computed from the theory of dissociative equilibrium. A. HU.

523.821 = 4 2455

On the absolute magnitudes of the helium stars. GUINTINI, P. *C.R. Acad. Sci., Paris*, **222**, 371–3 (*Feb.* 11, 1946) *In French.*—Using the proper motions and radial velocities of stars from the catalogues of Moore and Boss, the author calculates a correction to the adopted mean values of the absolute magnitude. Constants for the effect of galactic rotation and that due to absorbing material are inserted. The results for each sub-type are tabulated. E. G. M.

523.841.9 : 523.877 *see Abstr.* 2464

523.852.22 : 523.877 2456

Physical processes in gaseous nebulae. XVIII. The chemical composition of the planetary nebulae. ALLER, L. H., AND MENZEL, D. H. *Astrophys. J.*, **102**, 239–63 (*Sept.*, 1945).—Relative abundances of the lighter elements in planetary nebulae are estimated from line-intensity measurements. Ionic abundances are derived from the forbidden lines by an approximate calculation of target areas for the collisional excitation of metastable levels. The permitted recombination lines of He, C and O are also used in conjunction with estimated transition probabilities. The problem of ionization by radiation from the hot central star is considered; stratification, filamentary structure and the bright-line character of the exciting spectrum render it impossible to explain the nebula in terms of shells of gas exposed to black-body radiation. An empirical method is developed for estimating the contribution of the unobservable ions, and final abundances are calculated. The composition is substantially the same as that of the solar atmosphere.

A. HU.

523.872 2457

The spectrum of T Coronae Borealis in 1946 and 1866. PETTIT, E., SANFORD, R. F., AND MCLAUGHLIN, D. B. *Publ. Astr. Soc. Pacif.*, **58**, 153–63 (*April*, 1946).—The light curve, based on 14 measures with a visual wedge photometer, shows a maximum rate of decline of 0·48 mag/day as compared with 0·63 in 1866 (based on Schmidt's estimates). Corrections are indicated to the 1946 curve, assuming a companion to the nova of type M2 and magnitude 10·2. Outstanding features of the spectrum are the great strength of He II emission (4 686 Å) at an early stage, the rapid narrowing of emission bands and the presence of "coronal" lines of [Fe X] and [Fe XIV]. McLaughlin suggests that the general behaviour in 1866 has been almost precisely repeated. Sharp absorption lines of Ca II and Na I measured by Sanford, showing radial velocities of −24·0 km/sec (or −6·3 when corrected for solar motion), may be of interstellar origin. D. L. E.

523.872 : 539.153.4 : 537.228.5 *see Abstr.* 2601

523.877 2458

Note on the Cowling model of a convective-radiative star. SEN, N. R., AND BURMAN, U. R. *Indian J. Phys.*, **18**, 212–15 (*Aug.*, 1944).—The mutual consistency of Bethe's energy-generation law and the Cowling model is studied from three different points of view. Reasonable consistency is obtained for the sun, assuming 35% hydrogen, and central density and temperature 43 g/cm³ and $20{\cdot}3 \times 10^6$ deg. T. G. C.

523.877 2459

On the radial pulsation of gaseous stars. LEDOUX, P. *Astrophys. J.*, **102**, 143–53 (*Sept.*, 1945).—The virial theorem is applied to steady radial pulsations in a gaseous star, and the approximate formula found earlier for the period [Abstr. 2023 (1941)] by a variational method is re-derived. The treatment is extended to the case of steady uniform rotation, and the formula for the period, if the mass-distribution is homogeneous, is derived directly from a theorem of Poincaré. The conditions in which the decrease in period due to rotation is small are studied. A. HU.

523.877 2460

On the internal constitution of stars of small masses according to Bethe's law of energy generation. SEN, N. R., AND BURMAN, U. R. *Astrophys. J.*, **102**, 208–15 (*Sept.*, 1945).—The Cowling model gives, with Bethe's law of energy generation, a satisfactory fit with observation for stars of mass *M* and luminosity *L* comparable with the sun's. The H content is about 35% and the central temperatures T_c range between 19 and 22 million °C. An empirical formula is given for calculating T_c from *M* and *L*. A. HU.

523.877 2461

A stellar model with a gravitational source of energy. HARRISON, M. H. *Astrophys. J.*, **102**, 216–22 (*Sept.*, 1945).—A stellar model with negligible radiation pressure and a convective core, and in which the energy generation ∝ temperature, is studied. The core includes 14% of the radius and 10% of the mass. The formulae found for the central density, temperature and pressure and the luminosity closely resemble those for the Cowling point-source model.

A. HU.

523.877 2462

The problem of the internal constitution of stars. SEN, N. R. *Bull. Calcutta Math. Soc.*, **38**, 1–9 (*March*, 1946).—A general review of work on the subject.

T. G. C.

523.877 2463

Near thermodynamic radiative equilibrium. HENYEY, L. G. *Astrophys. J.*, **103**, 330–48 (*May*, 1946).—A radiation field is assumed, differing slightly from black-body radiation. Electrons are assumed to possess a Maxwellian velocity-distribution function corresponding to a temperature T_e. The problem solved is, assuming radiative equilibrium, to determine T_e and the population of each possible energy state. A perturbation method is employed, the unperturbed state being that of equilibrium in black-body radiation; explicit expressions for all the perturbations are given.

T. G. C.

523.877 : 523.841.9 2464

On the radiative equilibrium of a stellar atmosphere. IX. CHANDRASEKHAR, S. *Astrophys. J.*, **103**, 165–92 (*March*, 1946).—[See Abstr. 2026–2028 (1946)]. The problem of diffuse reflection by a semi-infinite plane-parallel atmosphere is considered, with special reference to the reflection effect in eclipsing binaries, planetary illumination and the interpretation of reflection nebulae. Explicit solutions are found for the cases when atmospheric scattering is governed by two particular phase functions, one that of Rayleigh and the other designed to fit the problem of planetary illumination. Simple closed expressions are found for the angular distribution of the reflected radiation which can be brought to their numerical forms by solving simple algebraic equations for their characteristic roots.

A. HU.

523.877 2465

On the radiative equilibrium of a stellar atmosphere. X. CHANDRASEKHAR, S. *Astrophys. J.*, **103**, 349–68 (*May*, 1946).—The theory of radiative equilibrium of an atmosphere in which the transfer of radiation is governed by Thomson scattering by free electrons is developed. The scattered radiation is polarized, and separate equations of transfer are set up for the components in which the electric vector vibrates in the meridian plane and at right angles to it. A general nth-approximation solution is derived and evaluated numerically for $n = 2$ and 3. Different laws of darkening are predicted for the two components, and the degree of polarization varies from zero at the centre of the disc to 11% at the limb.

A. HU.

523.877 2466

A shell source model for red giant stars. GAMOW, G., AND KELLER, G. *Rev. Mod. Phys.*, **17**, 125–37 (*April–June*, 1945).—Shell-source stellar models with partially degenerate cores are constructed approximately by fitting isothermal cores to radiative envelopes. Schönberg and Chandrasekhar's results [Abstr. 575 (1943)], assuming non-degenerate cores, are considerably modified. As the core grows more massive, stars of small mass (0·1 M⊙) become white dwarfs; stars of great mass (4 M⊙) become red giants.

T. G. C.

523.877 2467

Stellar models with partially degenerate isothermal cores and point-source envelopes. HARRISON, M. H. *Astrophys. J.*, **103**, 193–206 (*March*, 1946).—Extensive numerical integrations are made for the composite model considered, with the ratio of mean molecular weights in core and envelope either 1 or 2. The results disagree with recent suggestions by Gamow and Keller [Abstr. 2466 (1946)] that such models might explain red giants; general objections to these suggestions are also advanced.

T. G. C.

523.877 : 523.852.22 *see Abstr.* 2456

526.36 = 3 2468

The problem of determination of true heights above sea level and its solution in Switzerland. NIETHAMMER, T. *Experientia*, **1**, 146–53 (*Aug.* 15, 1945) *In German.*—Pendulum determinations of gravity are carried out by the Swiss Geodetic Commission at 230 stations of which 125 are situated on the lines of geometric levelling. This gives an average distance of 24 km between the stations and the values at the (many) required intermediate points are obtained by an interpolation process which is explained. The geometric levelling net is linked with those of France, Italy, Austria and Germany and heights are referred to the Pierre du Niton in Geneva harbour. The method of correcting the geometric levelling observations is explained. The mean error is ±1·40 mm/km. The true height of a point above sea level is determined from the mean value of gravity along the plumbline at the point, the gravity values along the geometric levelling line and the height as determined from geometric levelling.

J. A. W.

526.913 : 531.74 *see Abstr.* 2492

526.918 = 5 2469

On errors due to the inclination of photograms in radial triangulation with horizon images. PRATELLI, G. *Atti Accad. Torino*, **78** (*Tomo I*) 3–21 (1942–1943) *In Italian.*—A theoretical note dealing with errors introduced by a slight inclination of the plane of the photogram to the horizontal. It is shown that in the case of chains of triangles or polygons, this produces no errors of scale or direction.

V. C. A. F.

PHYSICS 53

53.081 2470

On unities and dimensions. III. DORGELO, H. B., AND SCHOUTEN, J. A. *Proc. K. Ned. Akad. Wet.*, **49** (*No.* 4) 393–403 (1946).—[See Abstr. 1790 (1946)]. It is suggested that systems with 3 fundamental units are impracticable because of fractional exponents, and

it is considered necessary to introduce a fourth unit, the rationalized system of Giorgi being recommended. There is no strong motive for introducing a fifth unit in spite of Sommerfeld's opinion [Abstr. 632 (1940)] that this is advisable because of the fact that the neutron has a magnetic moment but no electric charge. L. S. G.

53.081.1 = 4 2471

Two new secondary metric units. CALLOU, L. *C.R. Acad. Sci., Paris,* **218,** 66 (*Jan.* 10, 1944) *In French.*—The two new proposed units are the *spat* (S), equal to 10^{12} metres, and the *stigma* (σ), equal to 10^{-12} metres. The former would allow reasonable numbers in specifying astronomical distances, e.g. the distance of α-Centauri from the earth is 40·8 S, and the latter would be useful in atomic physics, e.g. the diameter of a He molecule is 192 σ, the wavelength of the Na D_1 line is 589·6 $K\sigma$, the diameter of an electron is 5·6 $m\sigma$. L. S. G.

53.081.1 : 535.241 *see Abstr.* 2540

53.088.3 : 519.213 *see Abstr.* 2441

FUNDAMENTALS 530.1

530.12 2472

Relativity transformations connecting two systems in arbitrary acceleration. SOH, H.-P. *Nature, Lond.,* **158,** 99–100 (*July* 20, 1946).

530.12 : 531.51 2473

On a curious solution of relativistic field equations. NARLIKAR, V. V., AND KARMARKAR, K. R. *Curr. Sci.,* **15,** 69 (*March,* 1946).—A metric has been discovered which is Riemannian (non-flat), satisfies the field equations of gravitation for empty space, is free from singularities and for which the pseudo-tensor density of gravitational energy and momentum is everywhere zero.

530.14 2474

Meson theories in five dimensions. ROSENFELD, L. *Proc. Ned. Akad. Wet.,* **45** (*No.* 2) 155–8 (1942).—It was pointed out by Møller that the "mixed theory" presents itself in a natural way as a single type of meson field in a 5-dimensional space, and the other types of fields which are *a priori* possible are now discussed, starting with the "particle aspect" of meson theory [Abstr. 4466 (1939)], in which the different possible types of meson fields are given by the inequivalent irreducible representations of the algebra of certain matrices. In 5 dimensions there are four such representations of degrees 6, 10, 10 and 15, corresponding to a 5-scalar, two distinct 5-pseudo-vectors and a 5-vector type of meson field. These are discussed, and it is concluded that the 5-dimensional point of view, while not excluding any of the 4-dimensional types of meson theories, singles out the mixed theory as the only combination of 4-dimensional types which can be derived from an irreducible 5-dimensional type of field. The importance of the mixed theory in the theory of nuclear forces is discussed. L. S. G.

530.14 = 4 2475

Expansors. COURTOIS, J. *C.R. Acad. Sci., Paris,* **222,** 377–8 (*Feb.* 11); 480–2 (*Feb.* 25, 1946) *In French.*—Some properties of Dirac's expansors are briefly developed. [See Abstr. 1242 (1945)]. W. E. D.

530.145 = 4 2476

A new type of unitary theory—study of the particle of spin 2. TONNELAT, M. A. *Ann. Phys., Paris,* **17,** 158–208 (*Jan.–Feb.,* 1942) *In French.*—An attempt is made to construct a unitary theory in connection with particles of maximum spin 2. The appropriate wave equation is constructed by operating on de Broglie's equation for particles of unit spin in the same manner as de Broglie derived his equation from that of Dirac's for an electron. This wave equation yields a wave function with 256 (4^4) components. These are treated as components of a tensor from which can be derived the various physical quantities associated with the particle. These fall into 6 independent groups. The first is associated with spin 2 and results in 3 quantities which, when appropriate approximations are made, yield respectively the gravitational potential, the Riemann–Christoffel symbols and the curvature tensor. The next 3 groups are linked with unit spin and lead to generalized Maxwellian equations containing terms involving the mass of the particle, thus describing either photons or mesons. The final 2 groups describe the state of zero spin. Finally, the problems of propagation of plane waves and field quantization are dealt with, and definitions are given of a 4-vector flux density and of 3 symmetrical tensors of the second rank. W. E. D.

530.145 = 4 2477

Certain formulae associated with plane waves of particles with spin $nh/4\pi$. VAN ISACKER, J. *C.R. Acad. Sci., Paris,* **222,** 375–6 (*Feb.* 11, 1946) *In French.*—There are given (*a*) the equation of such particles in the presence of an electromagnetic field; (*b*) the solutions of this equation, which involve some rectangular matrices required for the calculation of scattering cross-sections of these particles [see Abstr. 2478 (1946)]; and (*c*) some properties of these matrices. W. E. D.

530.145 = 4 2478

Effective cross-section of scattering of particles with spin $n/2$. GÉHÉNIAU, J., AND VAN ISACKER, J. *C.R. Acad. Sci., Paris.* **222,** 484–6 (*Feb.* 25, 1946) *In French.*—An approximate formula is given for the scattering cross-section for these particles and special values of n are considered, noting that for $n > 2$ the rest mass of the particle has more than one proper value. W. E. D.

530.145 2479

On the divergence difficulty of quantized field theories and the rigorous treatment of radiation reaction. PENG, H. W. *Proc. Roy. Soc. A.,* **186,** 119–47 (*June* 4, 1946).—A general description is given of the interaction of elementary particles by means of a quantized field. An orthodox application of the perturbation theory to the case of a generalized quantized field fails because of a faulty application of the expansion method, with resulting divergence difficulties. The unperturbed system is degenerate and if this is properly treated by the method of secular perturbation the divergence disappears. The method is studied in detail. Physically it amounts to a rigorous treatment of the radiation reaction, when this is strong, and the position is demonstrated by means of an example dealing with the interaction between a meson field and a nucleon field. Finite self-energies and cross-sections may be calculated. L. S. G.

530.145 : 537.123 2480

On the self-energy of mesons. PAIS, A. *Physica, 's Grav.*, **12**, 81–96 (*June*, 1946).—The self-energy of mesons is composed of contributions due to their interaction with the electromagnetic, the electron-neutrino and the nucleon field. Furthermore, if it is supposed that a particle creating an electromagnetic field also creates a short range neutral scalar field the latter also contributes to the self-energy. The various first order self-energies are computed. Mutual compensation of the divergences by means of convergence relations is not possible for any kind of meson.

530.145.63 2481

Redundant zeros in the discrete energy spectra in Heisenberg's theory of characteristic matrix. MA, S. T. *Phys. Rev.*, **69**, 668 (*June* 1 *and* 15, 1946).

530.162 : 536.7 2482

On Onsager's principle of microscopic reversibility. CASIMIR, H. B. G. *Philips Res. Rev.*, **1**, 185–96 (*April*, 1946). *Rev. Mod. Phys.*, **17**, 343–50 (*April–July*, 1945).—After a short synopsis of Onsager's theory of reciprocal relations in irreversible processes, the theory is applied to a number of simple examples. The thermomolecular pressure difference is first considered. Secondly, the conduction of heat is studied and it is shown that Onsager's relation leads to $\sum \partial_i L_{[ik]} = 0$ rather than to $L_{[ik]} = 0$. Finally the conduction of electricity is discussed by first deriving a relation of symmetry for an arbitrary quadripole from which a symmetry relation for the conductivity tensor is then easily deduced.

MECHANICS OF SOLIDS 531

531.19: 538.11 *see Abstr.* 2630

531.224.4 2483

On a special case of bending. BIEZENO, C. B. *Proc. Ned. Akad. Wet.*, **45** (*No.* 5) 438–42 (1942).—A highly elastic beam freely supported at two points, distant l apart, is subjected to a transverse load P, acting in the middle of the span. The beam is supposed to slide freely over its supports so that great deflections are expected under relatively small loads. A graphical solution of the deflection problem is given. It is a step-by-step method and the quantities that may be found are the deflection, the slope of the central line at a support and the length of the deflected beam between the supports. L. S. G.

531.224.4 2484

The buckling of flat rectangular plywood plates. GREEN, A. E., AND HEARMON, R. F. S. *Phil. Mag.*, **36**, 659–88 (*Oct.*, 1945).—The general equations governing the buckling of a thin rectangular plate of any aeolotropic material under the action of stresses along its edges are set up and the stability equation is solved by a double-Fourier-series method [Abstr. 1615 (1945)] both for simply supported edges and for clamped edges. The results are applied to plywood plates, cut at any angle to the grain, and the main numerical results are given for plates of mahogany 5-ply, with all the plies of equal thickness. Pure compression and pure shear are considered. The influence of plywood structure, of wood species and of other edge conditions are briefly discussed. L. S. G.

531.224.4 2485

Column formula for materials of variable modulus. VAN DEN BROEK, J. A. *Engng J., Montreal*, **28**, 770–7, 783 (*Dec.*, 1945).—Formulae are derived for the limiting strength of eccentrically loaded columns. These fit the experimental results closely. Tests are made on 24 ST aluminium alloy extruded columns, and the results are presented graphically for comparison with the theoretical formula. L. S. G.

531.224.4 : 624–434.1 = 397 2486

Buckling by heating of a circular cylindrical shell confined within a rigid medium. BERGMAN, S. G. A. *Tekn. Tidskr.*, **76**, 95–7 (*Jan.* 26, 1946) *In Swedish.*—A cylindrical shell of given dimensions and elastic properties is surrounded by a non-yielding medium, the circular edges being *encastré* and there being no friction between the outer surface and the rigid medium. The temperature at which buckling occurs is determined. J. A. W.

531.224.6 2487

Cantilever beams of uniform strength. OPATOWSKI, I. *Quart. Appl. Math.*, **3**, 76–81 (*April*, 1945).—The shapes of some cantilevers are worked out in certain special cases. The solution of a Volterra integral equation is involved. The external load is taken to be an isolated force acting at the free end, but more general loads are briefly considered. Some numerical examples are given. L. S. G.

531.224.6 2488

Large deflection of cantilever beams. BISSHOPP, K. E., AND DRUCKER, D. C. *Quart. Appl. Math.*, **3**, 272–5 (*Oct.*, 1945).—It is pointed out that a large deflection cannot be obtained from an elementary beam theory [Abstr. 1258 (1945)] since this neglects the square of the first derivative in the curvature formula, etc. A theory is now given which is in agreement with experimental observations. L. S. G.

531.224.6 2489

On the deflection of a cantilever beam. BARTEN, H. J. *Quart. Appl. Math.*, **3**, 275–6 (*Oct.*, 1945).—Corrections to a previous paper [Abstr. 1258 (1945)] are noted. L. S. G.

531.252 2490

On plane elastic strain in doubly-connected domains. PRAGER, W. *Quart. Appl. Math.*, **3**, 377–80 (*Jan.*, 1946).—If x, y, z are Cartesian co-ordinates, with the z-axis normal to the plane of strain, the stress function $\phi(x, y)$ satisfies $\Delta^2\phi = 0$ and the given stresses on the boundary determine the tangent planes of the stress surface $z = \phi(x, y)$ at all points of the boundary, when one such tangent plane is known for each boundary curve. If the domain is doubly connected two such tangent planes must be known. Only one can be chosen arbitrarily. A method is given for determining the second when one of the boundary curves is free from loads. It is shown that previously given equations for determining the tangent plane are the natural boundary conditions of the variational problem for the stress function. L. S. G.

531.381 = 393 2491

The stability of Staude's rotations. BOTTEMA, O. *Proc. Ned. Akad. Wet.*, **48**, 316–25 (1945) *In Dutch.*—A solid body supported in a point O different from the c. of g. G can rotate with constant speed round

an infinite number of axes through O [*J. f. reine u. angew. Math.*, **113**, 318–34 (1894); *Math. Zschr.*, **16**, 170–2 (1923)] and these axes are the quadratic complex of the principal axes of inertia. The question is, which of these axes are stable? Grommel's treatment is briefly sketched [*Math. Zschr.*, **6**, 124–42 (1920)] and the special case where G lies on one of the principal axes through O is dealt with in detail. The stability conditions are tabulated for the various relative values of the principal moments of inertia. J. A. W.

531.51 : 523.11 *see Abstr.* 2444

531.51 : 530.12 *see Abstr.* 2473

MECHANICAL MEASUREMENTS 531.7

531.74 : 526.913 2492

Precision of telescope pointing for outdoor targets. Washer, F. E., and Williams, H. B. *J. Opt. Soc. Amer.*, **36**, 400–11 (*July*, 1946).—The probable error of a single pointing (PE_s) is measured for a single telescope with a variety of targets. This investigation shows that, although some change in PE_s with distance does occur, the distribution of PE_s as a function of distance can usually be neglected and a value of 0·62 sec assigned as a practical average. The values of PE_s for an indoor target usually show a small variation from one experienced observer to another, and from right to left eye of the same observer. There is also a measurable systematic difference in pointing between the right and left eyes of the same observer. In outdoor pointing a long period error or drift is usually superposed upon the short period errors.

531.752 2493

The design of a quadrant balance. McDonald, I. G., and Pelton, M. O. *J. Sci. Instrum.*, **23**, 186–7 (*Aug.*, 1946).—The simple theory is used to show how a balance should be designed to give minimum variation of sensitivity over a given range of load. A form used for textile testing purposes is described and figures given indicate the degree of accuracy which has been attained with 4 balances covering different ranges.

531.787.087.44 : 535.33.072 : 541.127.1.08 2494

An apparatus for recording pressure on a spectrographic plate. Crawford, B. L., Jr., and Huggett, C. *Rev. Sci. Instrum.*, **17**, 213–15 (*June*, 1946).—The device records the varying pressure in an absorption cell on a moving photographic plate simultaneously with the absorption spectrum itself, which may be that of a gas undergoing a rapid chemical reaction. A spectrum of an auxiliary source is thrown on the spectrograph slit below the main beam, and a Bourdon gauge attached to a mirror traverses this spectrum across the slit in response to pressure changes. A portion of the auxiliary spectrum is chosen which avoids the main spectral region under investigation. The conditions for an approximately linear pressure scale are indicated.

531.787.2 2495

An accurate bellows manometer. East, H. G., and Kuhn, H. *J. Sci. Instrum.*, **23**, 185 (*Aug.*, 1946).—A manometer for laboratory use. The expansion and contraction of flexible metal bellows is transmitted to an optical lever. The instrument is accurate; has a quick response and avoids many of the difficulties of liquid manometers. By suitable choice of bellows, ranges from 0–100 to 0–2·5 mm of Hg can be obtained, with an accuracy of 1/5 000 of full range.

531.788.7 2496

Application of the ion gage in high vacuum measurement. van Valkenburg, H. E. *Gen. Elect. Rev.*, **49**, 38–42 (*June*, 1946).—Describes an ionization device suitable for continuous indication of pressures down to 10^{-8} mm. A relay is included which interrupts the filament current should the vacuum suddenly be lost. For lower pressures, discrepancies occurred between different instruments. The calibration and operation of the apparatus is easily made a matter of routine. N. C.

531.788.7 2497

A sensitive vacuum gauge with linear response. Downing, J. R., and Mellen, G. *Rev. Sci. Instrum.*, **17**, 218–23 (*June*, 1946).—The gauge is actuated by the ionization current resulting from a minute quantity of Ra. Range: 3 steps, 0–0·1, 0–1 and 0–10 mm Hg, selected by switch.

MECHANICS OF LIQUIDS 532

532.13 2498

Movement of a thin plate in non-Newtonian liquids. Mardles, E. W. J. *Nature, Lond.*, **158**, 199 (*Aug.* 10, 1946).—The edgewise movement of a thin plate is shown to be a more reliable means of investigating the viscosity of non-Newtonian liquids than the falling-sphere method, as it avoids effects due to volume displacement.

532.13 : 535.324.1 *see Abstr.* 2546

532.133 2499

A power law of the viscosity of liquids. Jones, W. J., and Bowden, S. T. *Phil. Mag.*, **36**, 705–10 (*Oct.*, 1945).—Homopolar liquids whose viscosities have been determined over a wide range of temperature are considered and a study of the experimental data shows that the viscosity, η, can be related to the temperature by a power law of the form $\eta - c = a(1 - T/T_c)^n$, where c, a, n are specific constants of the liquid and T_c is the critical temperature. The relation between the surface tension, viscosity and density of a liquid is also considered, especially in the case of dioxan and benzene. L. S. G.

532.133 : 535.551 : 541.64 = 393 2500

Theoretical aspects of viscosity and flow-birefringence in solutions of macromolecular substances. Hermans, J. J. *Physica, 's Grav.*, **10**, 777–89 (*Dec.*, 1943) *In Dutch.*—According to current ideas the molecules of high-polymers in solution are randomly kinked. Assuming that the shape of the molecule is characterized by the distance between the two ends, the continuous change of shape may be described by a *diffusion process*. A force is introduced, acting between the two ends of the molecule, thus maintaining a stationary distribution of the distance; it is thus possible to study the diffusion of the one end of the molecule with respect to the other in those cases where the equilibrium distribution is upset as a result of streaming. A new stationary distribution is arrived at, from which the viscosity and the birefringence of

flow may be calculated. The formula obtained for the viscosity confirms Staudinger's rule, while that for the birefringence of flow agrees with Signer's empirical rule.

532.5.032 = 5 2501

Motion of a quasi-ellipsoidal homogeneous, viscous liquid mass under its own gravitational attraction and that of distant centres of force. ZEULI, T. *Atti Accad. Torino*, **78** (*Tomo I*) 333–54 (1942–1943) *In Italian.*—For distant centres of force coplanar with one another and with the mass-centre of the mass, the terms due to viscosity disappear from the equations of motion if the velocity $v(P)$ of a particle P is assumed to be a linear vector function of the position of P. To examine the influence of viscosity on the motion of the liquid, the author therefore assumes that $v(P)$ is a quadratic vector function of the position of P. Following Poincaré's method for dealing with quasi-ellipsoidal figures, it is shown that there exist no purely ellipsoidal configurations, but that configurations whose boundaries deviate from the ellipsoidal form by terms of the third degree are possible. Necessary conditions for their existence are deduced. V. C. A. F.

532.517.2 2502

Laminar flow in radial direction along a plane surface. VAN WIJNGAARDEN, A. *Proc. Ned. Akad. Wet.*, **45** (*No.* 3) 269–75 (1942).—In the theory of laminar boundary-layer flow, as developed by Homann [Abstr. 3470 (1936)], the equation of continuity necessitates that the velocity component normal to the plane shall increase indefinitely with distance from the plane; consequently the field must be limited by another plane at a great distance. In the present paper, the field characterized by decreasing radial velocity along a single plane wall is investigated mathematically. A boundary layer equation of motion which is a special case of Hartree's equation [Abstr. 2389 (1937)] is obtained. A more general view of the problem is briefly discussed. J. S. G. T.

532.517.2 = 393 2503

Flow in a radial direction between two plane surfaces. VAN WIJNGAARDEN, A. *Versl. Ned. Akad. Wet. Afd. Natuurk.*, **52** (*No.* 1) 29–35 (1943) *In Dutch.*—The radial laminar flow of an incompressible viscous liquid between two parallel plane surfaces is considered. Use is made of the equations and methods applied in the investigation of boundary layer flow. It is supposed that the field is limited by a cylindrical boundary, situated either internally, in the case of outward flow, or externally, in the case of inward flow. By choosing an appropriate form of expansion for the stream function and for the velocity in the plane midway between the two parallel walls, it is possible to resolve the partial differential equation into an infinite system of ordinary differential equations, a solution of which can be constructed valid for small distances from the limiting cylindrical surface. A corresponding development can be obtained for the pressure.

532.517.4 = 4 2504

Statistical studies of turbulence: correlations and spectra in a homogeneous and isotropic turbulent flow. FRENKIEL, F. N. *C.R. Acad. Sci., Paris*, **222**, 473–5 (*Feb.* 25, 1946) *In French.*

532.521 = 4 2505

Liquid threads. CAMICHEL, C., AND BORY, C. *C.R. Acad. Sci., Paris*, **222**, 348–50 (*Feb.* 11, 1946) *In French.*—The period of vortices at the edges of liquid threads decreases as the Reynolds' number increases. The change of regime shows itself in the curves of different phenomena. W. A. R.

532.593 = 5 2506

Tidal waves of finite amplitude. UDESCHINI, P. *Atti Accad. Torino*, **78** (*Tomo I*) 320–32 (1942–1943) *In Italian.*—Using the method of characteristics, the author determines the wave velocity of tidal waves of finite amplitude on a canal and on a basin. For the case of a canal, the well-known formula for the velocity of propagation is deduced afresh by this method. In the case of a basin the velocity of advance of a point, and of propagation of the wave profile of the free surface is derived. The latter is equal to the square root of the product of the acceleration of gravity and the height of a point in the free surface above the bed of the basin. V. C. A. F.

532.593 : 550.342 = 393 *see Abstr.* 2699

532.61 2507

Introduction to the Conference on surface active agents. ANSON, M. L. *Ann. N.Y. Acad. Sci.*, **46**, 349–50 (*March* 15, 1946).—The surface-active agents which are the subject of this conference are almost all water-soluble substances which, even in small concentration, lower the surface tension of water considerably. The typical structure is characterized by a large hydrophobic group and a hydrophilic group attached at some one point; the latter may be positively or negatively charged, or neutral. The properties depend primarily upon the size and shape of the hydrophobic group and on the charge and location of the hydrophilic group. A surface agent to be useful in the food industry has not only to do its specific job but also has to be non-toxic and almost tasteless. H. H. HO.

532.61 : 541.18 2508

The structure and properties of solutions of colloidal electrolytes. RALSTON, A. W. *Ann. N.Y. Acad. Sci.*, **46**, 351–69 (*March* 15, 1946).—This paper is limited to a discussion of the structure and properties of solutions of colloidal electrolytes which pertain to the body of the solution itself; it must be realized that, in such solutions, there are actually many surfaces, such as colloid-solution or ionic micelle-solution interfaces, and that they probably do not differ fundamentally from those found at air-water interfaces. The equivalent conductivities of potassium acetate, palmitate and stearate are first discussed, followed by those of undecane, dodecane and tridecane sulphonic acids compared to hydrochloric acid, to amine hydrochlorides and to dodecylamine hydrochloride at various temperatures. The sharp break in equivalent conductivity has been attributed by McBain and others to highly charged ionic micelle formation, together with a large neutral colloid which contributes little or nothing to the conductivity. These two types of particle are in equilibrium, the relative amounts of each being dependent upon the concentration of the solution and the temperature. Hartley's argument against the presence of two types of micelle and in favour of one ionic micelle, formed by the association

of a number of high molecular weight ions to which particle are attached a number of oppositely charged ions, is described and discussed. Transference numbers and other properties are considered, and the final sections are devoted to a speculation as to why micelles are formed and what forces may be involved in the determination of their size, osmotic effects and electrical properties. H. H. HO.

532.61 : 532.694.1 2509

Surface active agents at interfaces. FISCHER, E. K., AND GANS, D. M. *Ann. N.Y. Acad. Sci.*, **46**, 371–406 (*March* 15, 1946).—In this paper the rational foundation for the use of surface-active agents is examined so far as it can be logically correlated with the facts of surface chemistry. This has involved (*a*) a general view of properties measured at the air-liquid, liquid-liquid and solid-liquid interfaces by a variety of experimental methods; (*b*) an evaluation of factors which affect the validity of such measurements and their interpretation; and (*c*) a brief survey of important industrial processes and products. The following applications of surface chemistry are included: foam formation, which, in its simplest form, represents primarily the air-liquid interface; emulsification, which is dependent chiefly on relations at the liquid-liquid interface; dispersion of solids in liquids, which presents the important and complicated case, typified by numerous commercial products; detergency, which requires a consideration of all three of these main classes of interfaces. The point of view adopted is a compromise between the demands of the moment, and the slow, sure progress based on sound theory and fundamental data. Basic to all the phenomena of the interface is the energy change involved, and many of the experimental techniques devised are intended to measure directly or indirectly the magnitude of this change. Also discussed are: correlation between interfacial tension and stability of emulsions, and anomalies given by long chain electrolytes (soaps). H. H. HO.

532.61 : 541.6 2510

Certain aspects of the chemistry of surface active agents. PRICE, D. *Ann. N.Y. Acad. Sci.*, **46**, 407–26 (*March* 15, 1946).—Surface-active compounds are classified as anionic or cationic, depending upon whether the hydrocarbon portion of the molecule acquires a negative or a positive charge upon ionization, and also the non-ionic surface-active compounds which possess water solubility in virtue of the multiplication of weakly hydrophilic groups in the molecule. The balance between the hydrophilic and hydrophobic portions of the molecule is of paramount importance. Anion-active compounds are described under paraffin-chain salt types; alkylated aromatic sulphonates; straight chain compounds; compounds in which the hydrophilic group is located near the middle of the carbon chain rather than at the end; compounds containing both aromatic rings and complex carbon chains; and heterocylic compounds such as the Na sulphonate of heptadecylbenzimidazole. Cation-active compounds such as dimethylaurylbenzylammonium chloride and non-ionic compounds such as the polyethylene ether of lauryl alcohol are mentioned. The relationship between constitution and performance of surface-active agents receives considerable attention. The wetting powers of the compounds as determined by the Draves test are given and discussed. H. H. HO.

532.61 2511

Properties involving surface activity of solutions of paraffin chain salts. SHEDLOVSKY, Z. *Ann. N.Y. Acad. Sci.*, **46**, 427–50 (*March* 15, 1946).—The preparation and properties involving surface activity are described for alternate members of a homologous and an isomeric series of purified Na salts of secondary alcohol sulphates and of primary alcohol sulphates with 10, 12, 14 and 16 C atoms. The surface tension, interfacial tension (benzene/water), foaming, wetting and detergent properties of solutions of these compounds are reported. The solubilities of those compounds which can be easily crystallized are measured at 5° intervals from 20–40°C. The data are discussed from the standpoint of correlating changes in the properties of the compounds when their structures and molecular weights are changed. The importance of considering the effects of small amounts of impurities which lead to minima in surface tension/concentration curves is discussed. It is shown that such minima can be attributed to the presence of at least 2 surface-active substances in the same solution. In all cases, attempts at selective adsorption at either an air-liquid or benzene-liquid interface have indicated these minima to occur at bulk concentrations where the relative surface concentration of the minor component is at a maximum. The changes in surface and interfacial tension of soap solutions as a function of *p*H are discussed. The effects of changes in concentrations and in *p*H upon the relative foam stabilities are reported for solutions of Na soaps. The surface and interfacial tension data can be useful in explaining these foam stabilities. H. H. HO.

532.61 : 577.15.033 2512

Surface active agents in biology and medicine. VALKO, E. I. *Ann. N.Y. Acad. Sci.*, **46**, 451–78 (*March* 15, 1946).—The biochemical effects of surface-active agents may be at least partly explained as follows: surface-active ions possess extraordinarily strong intrinsic affinity for proteins, and therefore combine readily with them. This combination causes disturbance of the intermolecular structure of proteins by upsetting the balance of the electrostatic forces, as well as that of the non-Coulombic cohesion in the molecule, at the same time, the interaction of the proteins with the solvent molecules may undergo profound changes and, as a further consequence, the bonds between the components of the conjugated proteins may be disrupted. Denaturation and unfolding of the protein molecules, inactivation of enzymes, viruses and bacteria are the manifest results of these processes. H. H. HO.

532.61 : 576.8.098 2513

The nature of the bactericidal action of surface active agents. HOTCHKISS, R. D. *Ann. N.Y. Acad. Sci.*, **46**, 479–93 (*March* 15, 1946).—The first stage of the interaction of surface-active agents and bacteria may be pictured as a combination of surface-active ions with oppositely charged sites upon the bacterial surface. This process may be prevented or perhaps even reversed through the competition of suitably constituted ions, such as phosphatides, other deter-

gents, and also H and OH ions. If the hydrophobic groups of the surface-active agent have the appropriate affinity for the bacterial surface, adsorption of a small fraction of the maximum amount that can combine will result in irreversible damage to the cellular membrane, so that the total content of soluble N and P compounds is released from the cell. This process appears to be the analogue for bacteria of the hemolysis of red blood cells by surface-active agents. At this stage, the cells are dead and their metabolic activity is very low, although morphologically they appear unchanged. The cells, after this cytolytic injury, are no longer able to repair themselves and begin to autolyse, so that cell constituents break down enzymatically and N and P compounds are liberated in greatly increased quantities. The rate and extent of this autolysis are characteristic for each bacterial species and strain. Low concentrations of surface-active agents appear to kill bacteria only when they simultaneously initiate the changes outlined above. H. H. HO.

532.61 : 622.765 2514

Surface active compounds in flotation ore dressing. HASSIALIS, M. H. *Ann. N.Y. Acad. Sci.*, **46**, 495–509 (*March* 15, 1946).—Flotation is a process for the separation of finely divided mineral mixtures, and the separation is effected by so treating the pulp with reagents that the surface of particles-to-be-floated becomes hydrophobic while the surface of other particles is hydrophilic; then, either by causing gas to precipitate on or come in contact with the hydrophobic-surfaced particles, a preferential selection of these particles is made. The resulting bubble-mineral aggregates are buoyed to the surface of the pulp, whence they are removed by scraping. The role of surface-active agents in flotation is of paramount importance, for they are used in all capacities, i.e. as collectors, conditioners and frothers. The close control of collection and frothing required in the differential flotation of metallic and non-metallic ores demands better understanding of the mechanics of the process and of the control of the various stages by proper selection of reagents. H. H. HO.

532.61 2515

The industrial use of surface active agents. ACKLEY, R. R. *Ann. N.Y. Acad. Sci.*, **46**, 511–29 (*March* 15, 1946).—This paper deals with the understanding of suitability of surface-active agents on the basis of the observed common physical properties. Difficulties in the prediction of suitability are first discussed, and followed by an evaluation of textile wetting agents. The effect of temperature on the wetting properties is then described, together with other factors which are involved in the selection of wetting agents. The precision of the Draves test is next discussed and followed by an evaluation of effectiveness in detergent operations. The tendency for film formation in gas bubbles beneath the surface of a liquid is briefly touched upon, prior to discussions of the significance of individual physical properties, such as surface and interfacial tension, and also of chemical properties in industrial applications. The paper concludes with some illustrative uses in industry. H. H. HO.

532.612.4 2516

The surface tension of slightly soluble fatty acids. DOUGLAS, D. G., AND MACKAY, C. A. *Canad. J. Res. A.*, **24**, 8–14 (*Jan., March, May*, 1946).—Surface tension measurements have been made on normal heptylic, pelargonic, capric and lauric acids above their melting points and on aqueous solutions of heptylic, pelargonic, capric and undecylic acids, at various concentrations. A modified capillary rise method was employed. The results indicate that the surface does not reach the stable state at once but requires considerable time, being slower for more dilute solutions and longer chain molecules. Evidence is given for the existence of a monolayer of closely packed molecules, with long axes perpendicular to the surface, each molecule occupying an area of approximately 25 Å for heptylic acid.

532.63 2517

Discontinuities and hysteresis in sorption in relation to the cavity concept. RAO, K. S., AND THIRUVENKATACHAR, V. R. *Curr. Sci.*, **15**, 103–4 (*April*, 1946).—[See Abstr. 971 (1941)].

532.64 : 620.197 2518

Rust preventive oils. PILZ, G. P., AND FARLEY, F. F. *Industr. Engng Chem.*, **38**, 601–9 (*June*, 1946).—The condensation of moisture in droplets on oil-coated steel parts produces a dynamic system composed of water, oil film and metal. A relationship has been established between contact angles and rust preventive ability. Contact angles were measured by a microscope fitted with a goniometer eyepiece; they have been employed in determining that solubility in water is of prime importance among the physical properties of rust preventive additives and have found application in controlling plant production of rust preventive oils.

532.694.1 : 532.61 *see Abstr.* 2509

532.7 : 539.6 = 4 2519

The liquid state: collision statistics and the internal equation of state. MÉRIGOUX, R. *C.R. Acad. Sci., Paris*, **222**, 533–5 (*March* 4, 1946) *In French.*—A one-dimensional model is used to estimate roughly a coefficient previously entirely empirical. [See Abstr. 2054 (1946)]. A. J. C. W.

MECHANICS OF GASES 533

533.15 : 539.155.2 2520

Performance of a hot wire Clusius and Dickel column. SIMON, R. *Phys. Rev.*, **69**, 596–603 (*June* 1 *and* 15, 1946).—The separation factor for A isotopes has been measured as a function of the gas pressure in a hot wire type of Clusius and Dickel column. The variation obtained is in accord with the predictions of the Furry, Jones and Onsager theory [Abstr. 2666 (1939)]. It is found empirically that their explicit expressions for the flat, parallel wall case can be modified to give correct results for the extreme cylindrical case if the constants of the gas are evaluated at the proper mean temperatures. The existence of turbulence in the gas causes a slight, if any, decrease in the separation factor determined by extrapolation from the experimental data obtained under conditions of lamellar flow.

533.15 : 539.155.2 *see Abstr.* 2649

533.5 2521

A multiple high-vacuum valve. GARROD, R. I. *J. Sci. Instrum.*, **19**, 190 (*Aug.*, 1946).

533.59 2522

The leakage of rubber sleeve joints under high vacuum. MUIRHEAD, G. S. *Chem. and Ind.* (*No.* 29) 298 (*Aug.* 10, 1946).—The measured rates of leak varied from 5×10^{-9} g/sec/cm for a rubber tube pushed over a dry glass tube, to $\frac{1}{10}$ of this when greased and wired.

533.59 : 621.385.832 2523

Leaking and controlling small quantities of gas. HUSBANDS, A. S. *J. Sci. Instrum.*, **23**, 191 (*Aug.*, 1946).

533.6.011.31 : 517.54 *see Abstr.* 2436

533.6.013.42 : 534.12 = 3 *see Abstr.* 2527

533.7 2524

Further studies on thermal repulsion. PARANJPE, M. K. *Proc. Indian Acad. Sci. A*, **23**, 233–53 (*May*, 1946).—A vane suspended between a hot and a cold surface has been used to study thermal repulsion under ideal convection-free conditions. The dependence of the repulsion on gas pressure, nature of the gas between the surfaces, temperature difference between the surfaces, width of the gap, area, orientation and material of the vane, and position of the vane relative to the gap have been examined. Explanations of the observed effects are suggested. The variation of the thermal repulsion when the vane is parallel and perpendicular respectively to the surface may be used to investigate the accommodation coefficient. W. R. A.

ACOUSTICS . VIBRATIONS 534

534.014.2 : 517.9 ≒ 4 2525

On the transient state preceding synchronization. HAAG, J. *C.R. Acad. Sci., Paris*, **222**, 314–16 (*Feb.* 4, 1946) *In French.*—A study is made of the transient state in the neighbourhood of resonance and with the synchronizing couple depending only on the time. The problem amounts to a study, by the methods of Poincaré, of the equation $y\{k\sin x - f(y)\}dx = (\varepsilon y + k\cos x)dy$, where ε is a parameter. When $\varepsilon \ll 1$ the two curves $k\sin x = f(y)$ and $\varepsilon y + k\cos x = 0$ cut in two points which are points of synchronization; one of these is stable and one unstable. If $\varepsilon \gg 1$ the curves have no common point and synchronization is not possible. L. S. G.

534.112 = 4 2526

Acoustic spectrum of a string. HOSTINSKY, B. *C.R. Acad. Sci., Paris*, **222**, 438–40 (*Feb.* 18, 1946) *In French.*—A mathematical paper dealing with the vibrations of a massless string loaded at equal intervals by equal masses. The possible frequencies of vibration are determined as the spacing and the masses are varied. The distribution of energy in the acoustic spectrum is calculated. A. B. W.

534.12 : 533.6.013.42 = 3 2527

A vibration problem in aircraft construction: rudder and flutter frequency. GROSSMANN, K. H., AND BADER, E. *Schweiz. Bauztg*, **126**, 39–42 (*July* 28, 1945) *In German.*—The frequencies are calculated by taking the equations of motion in the Lagrangian form and writing down the conditions for periodic solutions. Graphical results given show the variation of the frequencies with various parameters and these results are compared with those of the exact theory. L. S. G.

534.12 : 629.12.037 2528

On singing propellers. HUGHES, G. *Trans. Instn Nav. Archit., Lond.*, **87**, 185–216 (1945).—Singing is attributed to a "blow" caused by a sudden change of pressure accompanying a local "breakdown" of the flow on the back of the blade near the leading edge. The breakdown is of the nature of an increase of turbulence taking place during rapidly changing expansion of this flow. The shapes of the blade sections at the leading edge and the manner in which the angle of incidence varies in the mixed wake in which the propeller is working are deduced to be the chief factors affecting singing. The theory is developed to show how the propeller speeds for singing depend on these factors. An analysis is made of measurements of blade section shapes taken from 31 full-scale propellers, and of the average real flow conditions under which these propellers were working. [See Abstr. 1033 (1942)].

534.131 2529

The principal directions of loading and the principal directions of forced oscillation at a point of an elastic body or system. DUNCAN, W. J. *Phil. Mag.*, **36**, 715–19 (*Oct.*, 1945).—It is shown that there exist 3 real orthogonal principal directions of static loading, or of forced oscillation, for any point of a body or system which is conservative and obeys Hooke's law. In the case of a forced oscillation these directions generally depend on the frequency. The methods used involve the matrix calculus. L. S. G.

534.131 : 621–233.13 = 3 2530

On the calculation of the natural frequencies of crank shafts. NYFFENEGGER, H. *Schweiz. Bauztg*, **127**, 1–6 (*Jan.* 5, 1946) *In German.*—For the general case of piston engines with different moments of inertia of the moving masses and different distances between pistons ("inhomogeneous system," e.g. steam engines) and the special case with equal moments of inertia and distances ("homogeneous system," e.g. internal combustion engines) reduction methods are derived allowing of calculating the natural frequencies of the shaft by reducing the multi-mass system step by step to a single-mass system. For facilitating the calculations a diagram is given for the first case and a characteristic reduction number for any number of cylinders between 2 and 12 for the second case. Applications are discussed for 7 different arrangements of flywheels, generators, driving wheels, propellers or scavengers driven directly or by reduction gear; and formulae for determining the coefficients of the characteristic biquadratic equation for calculating the natural frequencies are tabulated. These applications cover stationary plant as well as vehicle, marine and aircraft propulsion. R. N.

534.321.9 : 534.614 *see Abstr.* 2533

534.321.9 : 539.32 2531

Determination of the elastic constants of isotropic media: a new method. BHAGAVANTAM, S., AND RAO, B. R. *Proc. Indian Acad. Sci. A*, **23**, 254–6 (*May*, 1946).—The characteristic transmission frequencies of plates of glass, steel and platinum have been studied by the ultrasonic diffraction method, a tourmaline wedge with a frequency range of 3–16 megacycles/sec being used. Both the longitudinal and shear fundamental frequencies are easily detected and measured

if the plate is sufficiently thin and small, and thus the elastic constants C_{11} and C_{44} may be evaluated. Consequently Young's modulus and the rigidity modulus may be obtained for each material, and the values agree well with those given by static methods. The method is particularly valuable when only small samples are available. The smallest plate used was 6 mm square. W. R. A.

534.321.9 : 591.185.5 2532

Supersonic cries of bats. GRIFFIN, D. R.; HARTRIDGE, H. *Nature, Lond.*, **158**, 46–8 (*July* 13); 135 (*July* 27, 1946).—Oscillograph studies have revealed no sign of any low-frequency component, audible to humans, in the bat's cry, so that the audible sounds mentioned by Hartridge [Abstr. 420 (1946)] are most likely transient components caused by the impulsive nature of the cry. This was found to be only 1–2 msec in duration, with a relatively rapid cut-off. There is also usually a fall of frequency of nearly an octave, during the pulse. Evidence is presented to show that the cry is not emitted through the nostrils, but that the nasal cavity may play a part in determining the envelope shape of the cry. Several criticisms are raised by Hartridge to Griffin's interpretations.

534.614 : 534.321.9 2533

Dispersion of the velocity and anomalous absorption of sound in hydrogen. STEWART, E. S. *Phys. Rev.*, **69**, 632–40 (*June* 1 *and* 15, 1946).—The velocity and absorption of sound in hydrogen were measured at 25°C at 3·855 and 6·254 Mc/s and pressures of 1·00, 0·83, 0·67 and 0·50 atm. Dispersion of the velocity from 1 321·9 m/sec to 1 382·0 m/sec and anomalous absorption which were observed are interpreted as caused by molecular absorption induced by loss of the rotational degrees of freedom. Calculations place the inflection point of the dispersion curve at 10·95 Mc/s and the peak of the absorption curve at 10·0 Mc/s from velocity data, and at 16·1 and 14·8 Mc/s from absorption data. The relaxation times for pressures of 1 atm. from the two sets of data are $1{\cdot}9$ and $1{\cdot}7\times10^{-8}$ sec. The f/p law is not strictly obeyed.

534.862.4 2534

A new method of counteracting noise in sound-film reproduction. WESTMIJZE, W. K. *Philips Tech. Rev.*, **8**, 97–104 (*April*, 1946).—Background noise is produced by specks of dust or tiny scratches, mainly on the transparent part of the film between the two edges of the sound-track. The paper describes a high-frequency method of scanning the edges of the sound-track, so that the influence of the part between the edges is eliminated, and consequently the background noise also. A series of light spots is used, moving at high velocity and at regular intervals across the film, in place of the narrow slit usually employed. A. B. W.

OPTICS . RADIATION . SPECTRA 535

535.13 = 4 2535

Huygen's principle and Maxwell's equations for vacuum. OSEEN, C. W. *Ark. Mat. Astr. Fys.*, **31 A** (*No.* 1) *Paper* 4, 17 *pp.* (1944) *In French.*—An integral relationship satisfied by the solutions, ϕ, of the equation $c^2\Delta\phi = \partial^2\phi/\partial t^2$ is established, this being analogous to Kirchhoff's demonstration of Huygen's principle. Similar relations are set up for the solutions of Maxwell's equations. L. S. G.

535.135 : 537.226.029.6 = 4 *see Abstr.* 2598

535.215 2536

On the interpretation of observations on the photo-electric voltages with intermittent light. GORTER, C. J., BROER, L. J. F., AND SNOEK, A. P. *Physica, 's Grav.*, **11**, 401–11 (*Feb.*, 1946).—The theoretical aspects of the experimental observations [Abstr. 2537 (1946)] are discussed. The saturation voltage V_s is considered on the basis of the diffusion theory, assuming the electrons and the positive holes to have the mobilities u_- and u_+, and further assuming either monomolecular or bimolecular recombination. The influence of light penetrating to the bottom of the layer and of the addition of constant light are discussed. General agreement exists between the experimental results and the theoretical formulae. The observed dependence of the voltage on the time is either due to the gradual appearance or disappearance of the electrons and the positive holes under the influence of recombination, or to the establishment of the equilibrium of diffusion, but not to a mixture of both processes. Formulae are given for the density n of electrons and positive holes, for the voltage in a thick layer after the commencement and the termination of illumination and for dV/dt at the moments of commencement and termination.

535.215 : 621.383 2537

On photoelectric voltages in light absorbing materials. SNOEK, A. P., AND GORTER, C. J. *Physica, 's Grav.*, **11**, 426–32 (*Feb.*, 1946).—Intermittent light from one side was used on a number of salts and oxides. In most substances the electrons travelled in the same direction as the light. During the illumination the voltage rises to a saturation value; at low intensities this value is not reached in a short time of illumination (e.g. 0·01 sec). At high intensities the saturation voltage is a linear function of the logarithm of the intensity of the light. At low intensities in the early stages of the illumination the derivative of the voltage with respect to time $\propto$ the intensity of the light. Its derivative immediately after the end of an illumination causing saturation is about equal, though of opposite sign. The addition of constant light in the same direction as the intermittent light reduces the saturation voltage. The addition of constant light in the opposite direction increases it to some extent, notably in somewhat transparent samples, which give lower voltages. [See also Abstr. 1547 (1941)].

535.23.08 2538

Statistical fluctuations in the temperature of a bolometer. MYERS, V. *J. Opt. Soc. Amer.*, **36**, 428–9 (*July*, 1946).

535.23.08 : 621.317.382.029.6 2539

The measurement of thermal radiation at microwave frequencies. DICKE, R. H. *Rev. Sci. Instrum.*, **17**, 268–75 (*July*, 1946).—The connection between Johnson noise and black body radiation is discussed, using a simple thermodynamic model. A microwave radiometer, consisting of calibrated wave-guide horn aerial and mechanically modulated (30 c/s) receiver, is described together with its theory of operation. The experimentally measured r.m.s. fluctuation of the

output meter (0·4°C) compares favourably with a theoretical value of 0·46°C. With an r.f. bandwidth of 16 Mc/s, the 0·4°C corresponds to a minimum detectable power of 10^{-16} W. The method of calibrating using a variable temperature resistive load is described.

535.232 : 621.396.821 : 523.32 : 523.72 *see Abstr.* 2449

535.241 : 53.081.1 2540

International names in colorimetry. MOON, P., AND SPENCER, D. E. *J. Opt. Soc. Amer.*, **36**, 427–8 (*July*, 1946).

535.243 : 545.822 2541

Note on the effect of plate calibration errors in spectrographic anaylsis. FAST, E. *J. Opt. Soc. Amer.*, **36**, 424–6 (*July*, 1946).

535.317.1 = 4 2542

Harmonic analysis of optical images. III. DUFFIEUX, P. M. *Ann. Phys., Paris*, **17**, 210–36 (*March–May*, 1942) *In French.*—A theoretical discussion of the uncertainties introduced in the interpretation of images, owing to the wavelength of the light. The analysis always results in a finite Fourier series whose period is related to this wavelength. Three uncertainties occur —in position of a point object, in structure of an extended object and in structure of an extended object known only from its image. It is shown that diffraction phenomena may be treated from concepts of probability. N. C.

535.317.1 2543

The physical study of optical images. MARTIN, L. C. *Photogr. J.*, **86 B**, 47–54 (*March–April*, 1946).—A general review, with historical introduction. A bibliography of 31 references is given.

535.317.7 2544

A contribution to the theory of the Foucault test. LINFOOT, E. H. *Proc. Roy. Soc. A*, **186**, 72–99 (*June* 4, 1946).—The 3-dimensional theory of the Foucault test is developed in a form which allows the prediction of the appearance under test of a mirror possessing smooth errors of figure of arbitrary shape. This theory depends very simply on the 2-dimensional theory and a general formula is derived for the intensities seen under test on a mirror of circular edge contour. The formula is applied to a discussion of the changes in the appearance of a true circular mirror under the test as the lateral setting of the knife-edge is varied. In the general case, series expressions are obtained for the intensities, and these are used to estimate the theoretical limits of sensitivity of the test, first as a means of determining focal position, and secondly as a means of detecting primary spherical aberration. L. S. G.

535.317.9 2545

The calculation of aspherical correcting surfaces. HERZBERGER, M., AND HOADLEY, H. O. *J. Opt. Soc. Amer.*, **36**, 334–40 (*June*, 1946).—A method is described for the calculation of the aspherical correcting surface of the Schmidt camera, or other optical system in which the aspherical surface is adjacent to the object or image. An extension of the method is also described for cases where the correcting surface is in the interior of the system, and the rays must be refracted to match a given non-spherical wave surface, instead of meeting at a point. The procedure of numerical calculation is described in detail, and selected figures are quoted from a representative system.

535.324.1 : 532.13 2546

On a relation between refractive index and viscosity of liquids. CHAKRAVARTI, A. S. *Curr. Sci.*, **15**, 105 (*April*, 1946).—The Lorentz equation for molecular refractive power is combined with the Rheochor equation [Abstr. 316, 2708 (1943)]. The new relation was found to fit the data for a number of unassociated liquids.

535.33 : 539.153 *see Abstr.* 2647

535.33.072 : 535.375.5 : 545.82 2547

A photoelectric Raman spectrograph for quantitative analysis. RANK, D. H., AND WIEGAND, R. V. *J. Opt. Soc. Amer.*, **36**, 325–34 (*June*, 1946).—Describes apparatus and method of use. The 4 358 Å Hg group is used as exciting radiation and the Raman spectrum analysed by a grating. The photocell is fixed, the spectrum being scanned by moving the grating. An automatic device marks the record at 5 Å intervals. The intensity of the Raman lines is recorded and is directly proportional to the concentration. Mixtures of up to 8 components have been analysed quantitatively by this instrument, the results being accurate within 2%. A complete record requires 30 minutes. N. C.

535.33.072 : 541.127.1.08 : 531.787.087.44 *see Abstr.* 2494

535.33.072–1 2548

Infra-red recording with the cathode ray oscilloscope. KING, J., TEMPLE, R. B., AND THOMPSON, H. W. *Nature, Lond.*, **158**, 196–7 (*Aug.* 10, 1946).—[See Abstr. 1568 (1946)].

535.33.08–15 : 621.383 2549

Investigations of near infra-red radiations by means of image convertors. VASKO, A. *Nature, Lond.*, **158**, 235 (*Aug.* 17, 1946).—The use of an electron-optical "image convertor" enables immediate inspection to be made of an infra-red spectrum, projected on to the photo-cathode. The wavelength limit is about 15 000 Å.

535.331 2550

On the spectra of neodymium and uranium. SCHUURMANS, P. *Physica, 's Grav.*, **11**, 419–25 (*Feb.*, 1946).—For Nd terms are given of the configurations $4f^46s^2$, $4f^46s$ and $4f^45d$. The (*jj*) coupling of the 6*s*-electron and the connection between the configurations are discussed. For U II terms are given of the configurations $5f^37s^2$, $5f^36d7s$ and $5f^36d^2$. In contrast with Th, no configurations without *f*-electrons were found.

535.331 = 4 2551

The vacuum spark spectrum of silver. BLOCH, L., BLOCH, E., AND TAO, L.-K. *Ann. Phys., Paris*, **20**, 1–51 (*Jan.–Feb.*, 1945) *In French.*—The vacuum spark spectrum of Ag has been measured in the region 6 900–2 270 Å. The lines are sharper and more numerous than in the spark in air, and masking by O and N lines is avoided. About 2 000 new lines are recorded. By use of an inductance in the circuit it has been possible to assign lines to Ag I, Ag II, Ag III and Ag IV. The spectra of Ag II and Ag III

have been considerably extended for wavelengths greater than 3 200 Å. Ag IV was not previously known. No analysis is given. The continuous spectrum characteristic of the spark in air is also emitted by the vacuum spark. A. G. G.

535.331 = 4 2552

Spark spectra of gold in vacuo. BLOCH, L., AND BLOCH, E. *Ann. Phys., Paris*, **1**, 70–87 (*Jan.–Feb.*, 1946) *In French.*—The Au IV spectrum has been obtained between 2 000 and 6 000 Å and is distinguished from lower orders of Au spectra. The wavelengths of the lines are given to 0·01 Å. N. C.

535.338.1 : 538.615 2553

Weak field Zeeman effect observations in the spectra of Th II, Nd I and Gd I. Structure of the Gd I spectrum; isotope shift of its lines. KLINKENBERG, P. F. A. *Physica, 's Grav.*, **12**, 33–47 (*April*, 1946).—Zeeman effect observations in the spectrum of Th II obtained by means of an interferometer mounting are compared with recent American high field measurements. The advantages and disadvantages of both methods are discussed. Some discrepancies between the interpretations of the detected Th II levels are pointed out. A hollow cathode light source which is more adapted to emit the neutral spectrum than an arc or the customary Back trembler, is employed for the study of spectra of the rare earth elements in low magnetic fields. A large number of Nd I splittings have been measured for the first time and given a preliminary classification. For 54 excited levels g-values can be deduced. Of 300 Nd I lines measured 50 are reported in this paper. Gd I lines show a complexity due to isotope shift, the components being resolved in 4 lines. Zeeman effect data on Gd I enable the classification of this spectrum given by previous authors to be consolidated and some terms interpreted. A hitherto unknown phenomenon, consisting in a rather strong depolarization accompanied by striking intensity anomalies of the magnetic components which are usually polarized perpendicularly to the field, is observed in the light from the hollow cathode source under proper conditions. It is attributed to the electric field in the tube and therefore called "electric depolarization of the Zeeman components."

535.338.334 2554

The pressure broadening of spectral lines. FOLEY, H. M. *Phys. Rev.*, **69**, 616–28 (*June* 1 *and* 15, 1946).—The Fourier integral expression for the intensity distribution in a pressure broadened line is derived from the quantum radiation theory with an adiabatic collision approximation. The phase shift approximation to the solution is obtained with the actual distribution of phase shifts taken into account. It is shown that in general there is a shift in line position as well as a line broadening, both proportional to the pressure. The ratio of the shift to the broadening depends only on the power of the intermolecular distance with which the interaction decreases. Experimental values of this ratio in foreign gas broadening are on the average consistent with the inverse sixth power. The predicted line widths are slightly larger than those given by Weisskopf. Good agreement with the observed line width is found for most of the alkali metals absorption lines. Calculated line widths and shifts are given for the vibration-rotation lines of linear polar molecules. A method for treating non-adiabatic collisions is given. The conditions for which the Lorentz line form transforms to the Margenau-type line form are indicated. It is shown that the Jablonski wave mechanical treatment of translational motion leads to the same line forms as the Fourier integral method under the proper physical conditions.

535.338.334 2555

Self-broadening in the 14μ band of HCN. FOLEY, H. M. *Phys. Rev.*, **69**, 628–31 (*June* 1 *and* 15, 1946).—The intensity distribution in the positive branch has been measured at pressures of 2·5 cm, 16 cm, 40 cm and 58 cm. Because of the large permanent dipole moment of this molecule, there is considerable line broadening at these pressures. The overlapping of lines, slit width effects and finite thickness of the absorbing layer of gas are taken into account in relating the theoretical line widths to the intensity distribution. The two constants giving the effective slit width and the absolute vibration intensity are determined from the low pressure lines, and these constants with the theoretical line widths determine the intensity distribution throughout the band. Reasonably good agreement is found at all pressures, and no systematic disparity of theory and experiment is indicated. The predicted shifts in the lines, which are just within the limits of detection, are in qualitative agreement with the observed values. The absolute value of the dipole strength of this vibration transition is determined.

535.338.4 = 5 2556

On the so-called "high-pressure" bands produced by an electric discharge in carbon monoxide. CICCONE, A. *Nuovo Cim.*, **19**, 1–8 (*Jan.*, 1942) *In Italian.*—Experiments carried out to study the fine structure of the bands are described, and the appearance of two bands around 4 680 and 4 368 Å is specially noted.

535.338.4 2557

Emission bands of bromine. VENKATESWARLU, P. *Curr. Sci.*, **15**, 123–4 (*May*, 1946).

535.338.4 : 535.343.31 : 539.132 2558

Polyatomic electronic spectra: further analysis of the vibrations of the $^1B_{2u}$ state of benzene. INGOLD, C. K., AND GARFORTH, F. M. *Nature, Lond.*, **158**, 163–4 (*Aug.* 3, 1946).—Earlier work [Abstr. 749 (1946)] is extended to in-plane vibrations, completing the determination of the force system of an excited polyatomic molecule. Some of the frequencies and force constants are given in tables.

535.338.4–31 2559

Ultra-violet bands of mercury iodide. RAO, V. R., AND RAO, K. R. *Curr. Sci.*, **15**, 70 (*March*, 1946).

535.338.4–31 2560

Ultra-violet bands of zinc iodide. RAO, P. T., AND RAO, K. R. *Curr. Sci.*, **15**, 122 (*May*, 1946).

535.342–31 : 541.651 2561

Ultra-violet absorption spectra of organic molecules. III. Mechanical interference of substituent groups with resonance configurations. RODEBUSH, W. H., AND FELDMAN, I. *J. Amer. Chem. Soc.*, **68**, 896–9 (*May*, 1946).—[See Abstr. 1786 (1942)].

535.343 2562

Long wave-length absorption bands of aromatic molecules. CRAIG, D. P. *Nature, Lond.*, **158**, 235 (*Aug.* 17, 1946).—The weak band of phenanthrene at 3 400 Å is shown to be due to a transition between the two lowest levels, both of which are symmetric.

535.343–15 2563

Infra-red spectra and state of aggregation. THOMPSON, H. W. *Nature, Lond.*, **158**, 234 (*Aug.* 17, 1946).—Differences in spectra between the solid, liquid and gaseous states have been observed with non-polar as well as polar substances, and the spectra of solid and liquid 3-ethyl-tetracosane illustrated show differences of relative intensity as well as number of bands.

535.343.31 : 539.132 : 535.338.4 *see Abstr.* 2558

535.343.32 : 535.347 = 4 2564

Absorption band of the Ni^{++} ion in the near ultra-violet for aqueous solutions of nickel sulphate. Pleochroism of the crystals $NiSO_4$, $6H_2O$ (quadratic) and $NiSO_4$, $7H_2O$ (orthorhombic). TRÉHIN, R. *Ann. Phys., Paris*, **20**, 372–90 (*July–Aug.*, 1945) *In French.*—The spectrum at six concentrations between 0·12 and 1·93 g.mol/l has been measured at 14·2°, using linear polarized light and natural light. Beer's law applies. The effect of temperature on the spectrum of the most concentrated solution was determined. The extinction coeff., k, increases linearly with temperature, and the maximum is displaced towards longer wavelengths the higher the temperature. In the case of the crystals the extinction coefficients have been calculated for thicknesses corresponding to the same number of Ni^{++} ions encountered by the light. The crystals are more transparent than the solution. The absorption and the position of the head of the band depend, in general, on the azimuth of the vibration, and in all cases on the direction of the light. The curves $k = f(\lambda)$ for $NiSO_4.6H_2O$ can be obtained from those for $NiSO_4.7H_2O$ by displacing them by 30 Å in the direction of shorter λ. For both the solutions and the crystals the curve of k against frequency is symmetrical with respect to the ordinate corresponding to maximum absorption. A. J. M.

535.343.32 2565

The absorption of light in aqueous solutions of dysprosium, holmium and thulium salts. HOOGSCHAGEN, J., SCHOLTE, T. G., AND KRUYER, S. *Physica, 's Grav.*, **11**, 504–12 (*March*, 1946).—The absolute intensities of the bands of the absorption spectra and the absorption probabilities are given.

535.343.32–15 2566

The light absorption in the near infra red region of praseodymium, samarium and ytterbium solutions. HOOGSCHAGEN, J. *Physica, 's Grav.*, **11**, 513–17 (*March*, 1946).—The absorption spectra of aqueous solutions of the chlorides and nitrates, and the absolute intensities of the absorption bands in the near infra-red region (11 000–7 000 Å) were determined by a photoelectric method. The wavelengths of the absorption maxima are tabulated and compared with the results of other authors. From the areas of the bands the probabilities of absorption are calculated.

535.343.32–31 2567

The absorption of light by neodymium salts in the near ultra-violet region. HOOGSCHAGEN, J., SNOEK, A. P., AND GORTER, C. J. *Physica, 's Grav.*, **11**, 518–20 (*March*, 1946).—The absorption spectra of aqueous solutions of $NdCl_3$ and $Nd(NO_3)_3$ were measured in the near ultra-violet region, and corrected values are given. [See Abstr. 1409 (1945)].

535.347 : 535.343.32 = 4 *see Abstr.* 2564

535.354 : 539.157 = 4 *see Abstr.* 2650

535.37 2568

Preparation and characteristics of zinc sulfide phosphors sensitive to infra-red. FONDA, G. R. *J. Opt. Soc. Amer.*, **36**, 382–9 (*July*, 1946).—In the presence of a relatively high percentage of Pb or certain other agents and after the usual excitation, Zn sulphide phosphors become capable of storing luminescence energy at such a high potential that, unlike phosphorescence, it can be released only by radiation with the near infra-red. There are two stimulating bands—a strong one at 1·25–1·60μ and a weaker one adjoining the visible. The resulting luminescence is increased by a small content of Cu. Its decay, under continued stimulation, is monomolecular in contrast to the decay of phosphorescence, which is bimolecular. In the case of Pb, the colour of the stimulated luminescence is green, that of the shorter of its two fluorescence bands. These fluorescence bands, in the green and yellow, are excited by different portions of the spectrum, and their phosphorescence decay is at different rates. After excitation at 77°K, there is also a bright emission observed on radiating with infra-red of 1–3μ, but this is due to the release of stored luminescence energy which is normally latent at 77°K, appearing at higher temperatures as phosphorescence. It does not affect the magnitude of the luminescence which is subsequently obtainable, after warming to 25°C, by stimulation with infra-red of the same range.

535.371 : 778.333 2569

Comparison of the afterglow properties of X-ray intensifying screens. STANWIX, G. W., AND MULLINS, L. *Photogr. J.*, **86 B**, 38–41 (*March–April*, 1946).—An apparatus is described which, by exposing film in successive regularly-timed steps to the screens after completion of the X-ray dose, enables the afterglow properties of 3 screens to be compared. The intensity, rate of decay and time of extinction (with respect to X-ray film) can be determined. The change in the quality of afterglow following repeated exposures, and the phenomenon of "latent afterglow," have been investigated.

535.375.5 = 4 2570

Note on the Raman effect in *p*-azoxyanisol. FREYMANN, R., AND SERVANT, R. *Ann. Phys., Paris*, **20**, 132–6 (*March–April*, 1945) *In French.*—Fifteen frequencies are observed for crystalline *p*-azoxyanisol. The spectrum for the nematic state is similar, but in the isotropic liquid state the frequency 1 247 cm^{-1} disappears. Use of the Hg green line for excitation avoids the strong absorption occurring with higher-frequency lines. A. J. C. W.

535.375.5 : 545.82 : 535.33.072 *see Abstr.* 2547

535.375.5 : 548.7 : 539.132 = 4 *see Abstr.* 2641

535.375.54 : 548.7 = 3 *see Abstr.* 2694

535.39 2571

German vacuum evaporation methods of producing first surface mirrors, semi-transparent mirrors, and non-reflecting films. *JIOA Rep.* (*No.* 9) (*H.M. Station. Off.*; *U.S. Dep. Comm.*) 29 *pp.* (1946).—Describes manufacturing methods used, consisting essentially of depositing thin films by evaporation in vacuo. Films of Al, Rh, quartz and cryolite are reported to have been used. The resultant mirrors are suitable for most purposes not involving exposure to the atmosphere. They may readily be re-coated at the factory, as deterioration affects only the coating, not the base. N. C.

535.39 2572

Thermally evaporated anti-reflexion films. BATESON, S., AND BACHMEIER, A. J. *Nature, Lond.*, **158**, 133–4 (*July* 27, 1946).—Practical experience in the baking of MgF_2 films is described, in particular the need to avoid deposition of "slow" fluoride molecules which have lost energy by reflection from the walls of the chamber or other cause. An undercoat of such molecules gives rise to films with poor adhesion.

535.391.2 = 4 2573

Specular reflection. ARZELIES, H. *Ann. Phys., Paris*, **1**, 5–69 (*Jan.-Feb.*, 1946) *In French.*—A theoretical study of the general case of reflection of electromagnetic waves at a plane surface, without assuming the magnetic permeability to be unity on both sides of the boundary. Discusses transmission through thin films, and claims that existing theory, based on Fresnel's treatment, is probably incorrect. An alternative theory is proposed and means of verifying it using centimetre and millimetre waves are suggested. N. C.

535.415 2574

Additional interference fringes produced by scattering and reflexion. HOPPER, V. D. *Nature, Lond.*, **158**, 101 (*July* 20, 1946).—A double system of interference fringes, produced by a combination of multiple reflection and scattering similar to that suggested by Bauchwitz and Schoenberg [Abstr. 2947 (1945)] was observed with an arrangement of aluminized and semi-aluminized optical flats with scattering scratches which is described.

535.421 2575

An integral equation method of solving plane diffraction problems. COPSON, E. T. *Proc. Roy. Soc. A*, **186**, 100–18 (*June* 4, 1946).—An electromagnetic field is incident, in the half-space $z > 0$, on a perfectly conducting screen in the plane $z = 0$, the screen containing holes. An integral equation method is given for calculating the total field in the half-space $z < 0$, and it is applied to Sommerfeld's problem of the diffraction of plane polarized waves by a perfectly conducting half-plane. The solution given by Magnus [*Z. Phys.*, **117**, 168 (1941)] is obtained much more simply by a Fourier integral method. Diffraction by a small circular hole or disc is also studied and Babinet's principle is enunciated and proved in a rigorous form. L. S. G.

535.551 : 541.64 : 532.133 = 393 *see Abstr.* 2500

535.641/.642 = 5 2576

Transformation from the colorimetric system of Ostwald to that of the C.I.E., 1931. DEAGLIO, R., AND RAVAZZI, M. *Atti Accad. Torino*, **78** (*Tomo I*) 139–44 (1942–1943) *In Italian.*—Describes a geometrical method for transforming from the number on the Ostwald colour scale to the trichromatic coefficients on the C.I.E. system. The results of a comparison between such a transformation and the values obtained experimentally are given. The agreement is not very satisfactory, partly owing to imprecise definition of the Ostwald "Vollfarben." J. W. T. W.

535.66 : 548.24 : 548.0 *see Abstr.* 2691

535.661.3 : 666.24/.25 *see Abstr.* 2719

HEAT . THERMODYNAMICS 536

536.2 2577

Analysis of numerical solutions of transient heat-flow problems. FOWLER, C. M. *Quart. Appl. Math.*, **3**, 361–76 (*Jan.*, 1946).—Expressions are derived for the solutions in terms of the initial temperatures and boundary values. Only the one-dimensional slab is considered and the initial temperature distribution is taken to be constant over the slab. But the method is capable of easy extension to 2- and 3-dimensional cases. The problems considered include the following: (1) Semi-infinite slab. Boundary $x = 0$ held at constant temperature. (2) Finite slab, length l, boundaries $x = 0$ and $x = l$ held at constant temperatures. (3) Finite slab, length l, insulated at $x = 0$, held at constant temperature at $x = l$. (4) Finite slab, length l, constant energy input at $x = l$, temperature kept at zero at $x = 0$. In each case the initial temperature is zero. Formal methods for establishing the convergence of the solutions are presented. L. S. G.

536.2 = 3 2578

The influence of surface structure on heat transmission. HOTTINGER, M. *Schweiz. Arch. angew. Wiss. Tech.*, **12**, 137–48 (*May*, 1946) *In German.*—The heat transmission coefficient between a solid wall and a fluid medium can vary between wide limits. It is very high for water vapour, lower for water and very low for dry air. The coefficient is also influenced by a number of factors, such as the removal of condensed liquid, the motion of the fluid and the orientation of the surfaces concerned. The coefficient can be calculated (neglecting radiation) and examples are given for various practical cases. The effect of radiation is then discussed and radiation coefficients quoted for a variety of materials. Empirical transmission coefficients are quoted for cases in which all mechanisms of heat transfer take part, and several practical examples of this kind are evaluated. H. K. H.

536.2.02 = 4 2579

Various forms of the equation of heat. Intrinsic equation. VERNOTTE, P. *C.R. Acad. Sci., Paris*, **218**, 39–41 (*Jan.* 4, 1944) *In French.*—The equation is firstly taken in the form,

$$\sum \frac{\partial}{\partial x}\left(k\frac{\partial T}{\partial x}\right) - c\rho\frac{\partial T}{\partial t} = 0$$

where T is the temperature and k the conductivity. By writing

$$k\frac{\partial T}{\partial x} = \frac{\partial W}{\partial x}, \ \ldots, \ k\frac{\partial T}{\partial t} = \frac{\partial W}{\partial t}$$

we obtain $\Delta W = c\rho k^{-1}\partial W/\partial t$, which is of the same form as the electric potential equation. W is called the heat potential. By considering the diffusion of heat the intrinsic equation is obtained in the form Δ grad $W = \partial F/\partial t$ where $F = \Delta W(\partial W/\partial t)^{-1}$ grad W. A method is outlined for determining k as a function of T. This is an important experimental and theoretical problem. L. S. G.

536.24.01 2580

On a problem of heat transfer between a moving medium and an extended solid. KRONIG, R., AND VAN GIJN, G. *Physica, 's Grav.*, **12**, 118–28 (*June*, 1946).—A solution is found in the form of rapidly converging series, which can also be written as complex integrals. A nomogram is given from which the difference between the initial temperature of the moving medium and the mean temperature of the extremities of a given length of solid as well as the temperature difference between these extremities can be obtained as function of the time of heating.

536.24.023 2581

Heat transfer from spheres to flowing media. KRAMERS, H. *Physica, 's Grav.*, **12**, 61–80 (*June*, 1946).—The overall heat transfer coefficient of three small spheres in a forced flow of air, water and oil was measured (in the latter two media at two different temperatures) using a stationary method. Using the dimensionless Nusselt, Prandtl and Reynolds' numbers, the following generalized expression is obtained from these experiments: $Nu = 2{\cdot}0 + 1{\cdot}3(Pr)^{0{\cdot}15} + 0{\cdot}66(Pr)^{0{\cdot}31}(Re)^{0{\cdot}50}$. For very small Re numbers this equation will give too high values of Nu. It is further shown that the known data on heat transfer from cylinders and wires of circular cross-section in a forced flow perpendicular to the axis can be described very well by: $Nu = 0{\cdot}42(Pr)^{0{\cdot}20} + 0{\cdot}57(Pr)^{0{\cdot}33}(Re)^{0{\cdot}50}$. Finally some theoretical results concerning these problems are discussed, from which it appears that theory has but partly succeeded in explaining the experimental facts.

536.242 2582

A cylinder cooling problem. SCHAAF, S. A. *Quart. Appl. Math.*, **3**, 356–60 (*Jan.*, 1946).—The Laplace transform method is used to solve the problem of an infinite circular cylinder at a given temperature, suddenly immersed in an infinite medium initially at zero temperature. The corresponding linear problem for non-homogeneous solids was solved earlier [Abstr. 255 (1941)]. L. S. G.

536.413 : 548.0 : 539.377 *see Abstr.* 2678

536.413.3 : 539.32 2583

Some remarks on the thermal expansion and the Poisson contraction of the cubic metals. DRUYVESTEYN, M. J. *Philips Res. Rep.*, **1**, 77–80 (*Jan.*, 1946).—The values of the Grüneisen constant γ and the Poisson ratio μ are compared for the metals of the two cubic structures. For the face-centred metals, $\gamma > 1{\cdot}8$ and $\mu > 0{\cdot}31$, while for the body-centred the reverse is generally true. For the values of γ, only one exception from this rule is found; for μ a number of exceptions exist. This differing behaviour is explained qualitatively.

536.421.1 2584

The melting line of carbon dioxide up to 2 800 atmospheres. MICHELS, A., BLAISSE, B., AND HOOGSCHAGEN, J. *Physica, 's Grav.*, **9**, 565–73 (*June*, 1942).—The blocked capillary method was used. A cryostat and temperature regulating system are described, which allowed the temperature to be controlled within 0·0003°C. A semi-experimental formula of Simon and Glatzel fits the experiments with an average error of 1·25 atm.

536.423.15 2585

Rapid and direct measurement of vapor pressure of liquid metals. WEBER, A. H., AND PLANTENBERG, G. *Phys. Rev.*, **69**, 649–51 (*June* 1 *and* 15, 1946).—The force of impact of evaporated particles is measured with a vacuum microbalance. The vapour pressure of Bi obtained by this method in a preliminary experiment is found to be in fairly good agreement with other measurements.

536.6 : 697.3 = 397 2586

The problem of heat measurement. SJÖSTEDT, S. *Tekn. Tidsskr.*, **76**, 25–32 (*Jan.* 12, 1946) *In Swedish.*—[Abstr. 2510 B (1946)].

536.7 2587

Thermodynamic equilibria of higher order. LYPE, E. F. *Phys. Rev.*, **69**, 652–65 (*June* 1 *and* 15, 1946).

536.7 2588

Thermodynamical properties of ethylene under pressures up to 3 000 atmospheres and temperatures between 0° and 150°C, tabulated as functions of density. MICHELS, A., GELDERMANS, M., AND DE GROOT, S. R. *Physica, 's Grav.*, **12**, 105–17 (*June*, 1946).

536.7 : 530.162 *see Abstr.* 2482

536.73 : 575 2589

Life and the second law of thermodynamics. BUTLER, J. A. V. *Nature, Lond.*, **158**, 153–4 (*Aug.* 3, 1946).—An estimate is made of the free-energy change associated with the building up of protein molecules by organisms from "dead" food such as sugar. The conclusion is reached that the free energy available in, for instance, glucose is ample for the purpose.

ELECTRICITY . MAGNETISM . X-RAYS CHARGED PARTICLES 537/538

537.122 = 4 2590

Relations between the average densities in the Dirac theory of the electron. PETIAU, G. *Rev. Sci., Paris*, **83**, 37–9 (*Jan.*, 1945) *In French.*—The average densities associated with the matrices of Dirac's relativistic equation for the electron, when considered in 4 dimensions, have been interrelated by means of 4 fundamental relations. By resorting to 5-dimensional space the present paper reduces the number of these relations to 2; moreover, a single relation is sufficient if a sixth co-ordinate, canonically conjugate with the mass of the electron, is introduced. W. E. D.

537.122 = 4 2591

Relations between mean value densities in Dirac's electron theory. PETIAU, G. *C.R. Acad. Sci., Paris*, **222**, 482–4 (*Feb.* 25, 1946) *In French.*

537.123 = 5 2592

The mean life of the mesotron. BERNARDINI, G., CACCIAPUOTI, B. N., PANCINI, E., AND PICCIONI, O. *Nuovo Cim.*, **19**, 69–98 (*March*, 1942) *In Italian.*—Experiments are described which were carried out at

Rome, at Cervinia (2 060 m) and at Pian Rosà (3 480 m) to determine the ratio of τ, the mean life, to μc^2, the rest energy of the mesotron. It is deduced that the most reliable value is $\tau/\mu c^2 = 2{\cdot}5 \times 10^{-8}$ sec/eMV, with an accuracy of the order of 25%.

537.123 2593

Absorption of slow mesotrons in lead, iron, aluminium, and water. KOENIG, H. P. *Phys. Rev.*, **69**, 590–6 (*June* 1 *and* 15, 1946).—The absorption was measured by means of counters arranged in anticoincidence. In all cases, the statistical error in the number of mesotrons stopped by the absorbing layers was <3%. This accuracy was made possible by the high efficiency (about 99%) of the anticoincidence group of counters. The values obtained for the relative absorptions in the different substances did not agree with those calculated from the theory of energy losses by collision (which predicts a smaller absorption in heavier elements for a given superficial mass), except by taking into account the effect of scattering, which is of particular importance in heavy elements. No reliable theoretical value could be calculated for water.

537.123 : 530.145 *see Abstr.* 2480

537.123 : 539.152.1 = 4 2594

The theory of the meson, and the electromagnetic properties of atomic nuclei. SERPE, J. *Physica, 's Grav.*, **11**, 495–503 (*March*, 1946) *In French.*—Møller and Rosenfeld's method of canonical transformation [*K. Danske Vidensk. Selsk. (Math.-Fys. Medd.)* **20** (*No.* 12) (1943)] has been applied to the interpretation of the electromagnetic properties of nuclear systems. Two examples were studied: (1) the electrostatic field near a proton; (2) the magnetic moment of nucleons.

537.212 2595

The two-dimensional electric field of a single semi-infinite rectangular conductor. DAVY, N. *Phil. Mag.*, **36**, 694–705 (*Oct.*, 1945).—The Schwarz–Christoffel transformation method is used to find the fields of (*a*) a single semi-infinite rectangular cylinder charged externally, and (*b*) a single semi-infinite thin-walled hollow rectangular cylinder charged internally. Equipotentials and lines of force are obtained and some of the results are verified by experiment. Calculations are made of the electric intensity, surface density, total charge and mechanical force. L. S. G.

537.212 : 621.319.7 = 4 2596

A note on the tracing of electric fields. BALACHOWSKY, M. *Bull. Soc. Franç. Élect.*, **6**, 181–6 (*April*, 1946) *In French.*—[Abstr. 2350 B (1946)].

537.226 = 4 2597

Variation of dielectric polarization with density. GUILLIEN, R. *Ann. Phys., Paris*, **16**, 205–52 (*Oct.–Dec.*, 1941) *In French.*—An experimental study of permittivity ε of spherical and non-spherical particles of KCl, $PbCl_2$ and Hg (ε_1) in various liquids (ε_2). Comparison with various theories shows that only that of Brugemann for heterogeneous mixtures explains satisfactorily the variation of ε with concentration for either type of particle. Measurements were also made of ε for liquids at various pressures and temperatures. The same theory agrees with the results if applied by assuming that a liquid consists of particles ε_1 of suitable volume immersed in empty space ($\varepsilon_2 = 1$). G. J. K.

537.226.029.6 : 535.135 = 4 2598

The dispersion and absorption of iso-butyl alcohol for wavelengths between 9 cm and 300 m. HÄFELIN, J. *Arch. Sci. Phys. Nat.*, **28**, 19–59 (*Jan.–Feb.*, 1946) *In French.*—Determinations of permittivity of iso-butyl alcohol pure and in various solvents were made. Strong and weak solutions in benzene behaved in accordance with Debye's theory. Medium solutions in benzene and all solutions in viscous liquids behaved differently from simple theory. It is suggested that a more detailed theory, taking into account the interaction between solvent and solute molecules, is required. Useful information about molecular structure may be obtained from this type of measurement. N. C.

537.226.2 : 677.21 2599

Dielectric properties of raw cotton. BALLS, W. L. *Nature, Lond.*, **158**, 9–11 (*July* 6, 1946).—A detailed description is given of the method of measurement, and the corrections required on account of the awkward nature of raw cotton, and the effect of moisture. It appears that the permittivity of cotton is 6 when measured along the fibres, and 3 transversely. An analogous experiment on wood gave a ratio of 1·6.

537.228.1 : 621.395 = 3 2600

Rochelle salt crystals and their application in telephony. SENGEWITZ, L. *Elektrotech. Z.* [*ETZ*], **62**, 463–5 (*May* 15, 1941) *In German.*—[Abstr. 2409 B (1946)].

537.228.5 : 523.872 : 539.153.4 2601

The interaction of a proton and a helium atom in its excited states. II. KROGDAHL, M. K. *Astrophys. J.*, **102**, 64–73 (*July*, 1945).—Previous work [Abstr. 2298 (1945)] on the calculation of the interaction energy between a proton and an excited He atom is extended to higher quantum numbers and to some singlet levels. Calculated shifts are given as a function of the nuclear separation for several lines of astrophysical interest. The non-homogeneity term, not occurring in laboratory Stark-effect measurements, is important in many cases. A. HU.

537.311.1 : 541.133 2602

Physical interaction of electrons with liquid dielectric media. The properties of metal-ammonia solutions. OGG, R. A., JR. *Phys. Rev.*, **69**, 668–9 (*June* 1 *and* 15, 1946).—A brief outline of the theoretical considerations relative to recent experimental discoveries [Abstr. 1894, 1950 (1946)].

537.311.31 = 4 2603

Measurements of electric resistance of superposed metallic films. VAN ITTERBEEK, A., AND DE GREVE, L. *Physica, 's Grav.*, **11**, 465–9 (*March*, 1946) *In French.*—An investigation on the electrical resistance of superposed metallic films. The films were formed by cathodic sputtering. Measurements were made on Cu films on which Ag films were deposited, and on Ag films upon which Cu films were laid. The resistance generally obeys Kirchhoff's law for 2 resistances in parallel, especially before sintering to 300°C, except when the first film is extremely thin, when the resistance

is always much smaller than expected under Kirchhoff's law.

537.311.31 = 4 2604

Measurements on thin films of nickel. VAN ITTERBEEK, A., AND DE GREVE, L. *Physica, 's Grav.*, **11**, 470–4 (*March*, 1946) *In French.*—The electrical resistance of films formed by cathodic sputtering was measured between 37°K and 650°C after sintering for 24 hours. The thickness varied between 30 and 700 mμ. Down to 200 mμ the temperature coefficient $\alpha = 1/R_0 \,.\, dR/dT$ still showed a sudden drop at the Curie point (360°C). The dependence of α on temperature and thickness, and of the specific resistance ρ at 0°C on thickness, before and after sintering, is shown in graphs. α becomes negative for films thinner than 40 mμ. [See Abstr. 501, 2605 (1946)]

537.311.31 2605

Resistivity of thin nickel films at low temperatures. VAN ITTERBEEK, A., AND DE GREVE, L. *Nature, Lond.*, **158**, 100–1 (*July* 20, 1946).—The temperature coefficient of films thicker than 40 mμ reverses its sign at a low temperature, which is higher, the thinner the film. The resistance thus goes through a minimum value. For films $\leqslant$40 mμ, the temp. coeff. is negative [Abstr. 501, 2604 (1946)].

537.311.31–96 : 537.312.62 2606

High-frequency resistance of superconductors. PIPPARD, A. B. *Nature, Lond.*, **158**, 234–5 (*Aug.* 17, 1946).—By measurement of the Q of a resonator composed of a $\lambda/4$ twin transmission line, the conductivity of Sn and Hg was measured for 1 200 Mc/s currents at low temperatures. The shape of the curve for Sn was in good agreement with London's [Abstr. 137 (1941)] and Hg showed a similar curve. The specific conductivity at a temperature just above the transition point was calculated to be only $\frac{1}{7}$ of the d.c. value for Sn, and about $\frac{1}{2}$ for Hg, if the standard theory of skin effect is assumed.

537.311.32 = 3 2607

Electric conductivity of silicon carbide. BUSCH, G. *Helv. Phys. Acta*, **19** (*No.* 3) 167–88 (1946) *In German.*—Variation of conductivity with potential gradient and temperature was measured by a probe method with specimens 1 cm long, 1 mm² cross-section, cut from single crystals of several colour-types. Ohm's Law was verified using a null method for current densities between 10^{-5}—1 A/cm². Temperature variations were reproducible for each crystal, showing a maximum at 700–1 400°K. For temperatures down to 80°K the values were fitted by two exponentials $A \exp(-\varepsilon/2kT)$. It is shown that $\log A$ is linear in ε, as previously found for some other semi-conductors.

G. J. K.

537.311.33 = 3 2608

Relation between the constant A and the activation energy ϵ in the conductivity law of semi-conductors. BUSCH, G. *Helv. Phys. Acta*, **19** (*No.* 3) 189–98 (1946) *In German.*—The apparent need for two exponentials, $A \exp(-E/2kT)$ with activation energies ε and $\varepsilon + \Delta E$ in the variation of conductivity of excess semi-conductors with temperature [Abstr. 2607 (1946)] is explained assuming a band of electron traps of finite energy width ΔE. The experimental variation of A between crystals of one substance ($\log A$ linear in ε) is deduced if traps are faults whose occurrence frequency depends exponentially on their energy.

G. J. K.

537.312.62 : 537.311.31–96 *see Abstr.* 2605

537.312.8 = 4 2609

Electric resistance of Ag films in a magnetic field at low temperatures. VAN ITTERBEEK, A., AND DE BOCK, A. *Physica, 's Grav.*, **12**, 163–76 (*June*, 1946) *In French.*—It was found that $\Delta R_{HT}/R_{0T} = B \,.\, H^2$, where R_{HT} = resistance in a magnetic field H perpendicular to the current at T°K, and B is a constant depending upon the specific resistivity. Taking into account the residual resistivity Z, $\Delta R_{HT}/(R_{0T} - Z) = B' \,.\, H^2$, B' being a new constant. For the thickest films B' corresponds with the value found for normal Ag; for the thinnest films large deviations appear and Matthiessen's rule is not valid. Control measurements were made on Cu wire. For the measurements at liquid oxygen temperatures a specially constructed cryostat was used with the purpose of eliminating the action of the magnetic field on the paramagnetic oxygen.

537.523.4 : 539.16.08 = 3 2610

On the mode of action of spark counters. FREY, P. *Helv. Phys. Acta*, **19** (*No.* 2) 41–76 (1946) *In German.*—Experiments with Greinacher spark counters and streams of gas of known vapour content investigate: counting range, the influence of electrode geometry, effect of water vapour on counting quality in air, influence of gases H_2, N_2, O_2, CO_2, the use of counters for quantitative measurements. In air with some electrodes, increase of dryness increases spontaneous sparking and diminishes counting range, but in H_2 or N_2 range disappears completely. Pt electrodes in air are only slightly sensitive to moisture and are very stable; spheres of Pt in dust-free air have large counting range. Using statistical analysis similar to that used in analysing spark time-lags, it is shown that spark counters reproduce the statistics of radioactive changes exactly. Using the distance law, the frequency of sparking in the counters is shown to be proportional to intensity of incident radiation. The sensitivity and size increase with applied voltage. For α-rays a flat counting curve can be obtained if a perforated cathode is used to utilize the most sensitive region of the sparking space. [See Abstr. 135 (1946)].

F. LL. J.

537.523.4 : 621.3.015.5 = 4 2611

On the physical mechanism of the spark. TESZNER, S. *Bull. Soc. Franç. Élect.*, **6**, 61–81 (*Feb.*, 1946) *In French.*—The problem of the spark mechanism is considered in two parts: (1) the transitory regime of establishing the spark, and (2) the established regime. The transitory regime is divided into three stages: (*a*) the setting-up of the current which leads to breakdown, (*b*) the actual breakdown involving collapse of potential to a step—the normal cathode fall, and (*c*) the transition to arc. For stage (*a*) the processes of production of the initial electrons are discussed on the basis of observed time-lag of sparking on impulse breakdown, and field emission is considered to be the most likely process. All theories of electron avalanche formation are discussed, and considered to be inadequate to explain time lags of 10^{-9} sec when

based on positive ion space charges. The author then proposes a mechanism based on electron space charges, which accelerate the avalanche in a cumulative effect, so accounting for time lags of 10^{-9} sec. The second stage of actual breakdown producing a high current is considered to involve the action of positive ions. The ionization balance is discussed on the basis of the Townsend conditions, but the two extra processes of electron photo-emission and thermal ionization are considered necessary. The stepping of the spark voltage during collapse is discussed and explained. For the third stage (*c*), it is considered that field emission is a more likely process than thermionic emission for transition to arc, but it is also shown that the cathode gas can be raised to the temperature of thermal ionization in 10^{-9} sec. In part 2, the above theory is applied to v.h.f. discharges. [See Abstr. 1647, 1320 (1946)]. F. LL. J.

537.525.83 2612

The contraction phenomenon in a neon glow discharge with molybdenum cathode. PENNING, F. M., AND MOUBIS, J. H. A. *Philips Res. Rep.*, **1**, 120–8 (*Jan.*, 1946).—Some time after starting the current, the negative glow in a Ne discharge with Mo cathode contracts to a small spot. This is explained by assuming that the cathode is normally covered with O_2, which is gradually removed by the glow discharge. The spot corresponds to the place where the pure metal is first exposed. Several observations confirm this explanation. Cleaning the cathode and covering the glass wall with a layer of sputtered Mo gives a reproducible value of the cathode fall which remains constant with time. [See Abstr. 2613 (1946)].

537.525.83 2613

The normal cathode fall for molybdenum and zirconium in the rare gases. JURRIAANSE, T., PENNING, F. M., AND MOUBIS, J. H. A. *Philips Res. Rep.*, **1**, 225–38 (*April*, 1946).—A stable and reproducible normal cathode fall for discharges with Mo and Zr electrodes could be obtained by covering the wall of the tube with metal produced by sputtering the cathode. This blackening of all non-cathodic parts is shown to be essential for the stability. The reproducibility is within several volts for different tubes and the stability is some tenths of a volt for 1 000 hr burning or rest time.

537.531 : 539.165 *see Abstr.* 2662

537.531.08 : 615.849 : 621.386.8 2614

A direct-reading X-ray intensity comparator: its radiological and physical applications. KEMP, L. A. W. *Brit. J. Radiol.*, **19**, 233–42 (*June*, 1946).—Abstr. 2398 B (1946)].

537.533 : 621.3.015.1 : 621.385.2 2615

Extension of Langmuir's (ξ, η) tables for a plane diode with a Maxwellian distribution of the electrons. KLEYNEN, P. H. J. A. *Philips Res. Rep.*, **1**, 81–96 (*Jan.*, 1946).—[Abstr. 2387 B (1946)].

537.533 : 621.3.015.1 : 621.385.2 2616

Extension and application of Langmuir's calculations on a plane diode with Maxwellian velocity distribution of the electrons. VAN DER ZIEL, A. *Philips Res. Rep.*, **1** 98–118 (*Jan.*, 1946).—[Abstr. 2386 B (1946)].

537.533.72 : 620.183.233.4 2617

"Shadow cast" replicas for use in the electron microscope. THIELSCH, M. *Metals Tech.*, **13**, 1–10 (*Feb.*, 1946).—[Abstr. 2227 B (1946)].

537.533.72 : 621.385.833 2618

A zonally corrected electron lens. GABOR, D. *Nature, Lond.*, **158**, 198 (*Aug.* 10, 1946).—An electron lens is described, consisting of a central cylindrical electrode, surrounded by various annular electrodes, which has been calculated to reduce the spherical aberration of a bundle of electrons from a conventional electron lens passing eccentrically through it. It is likely that the use of such a lens would have to be confined to this, as it is found that coaxial lenses cannot be designed with powers equal to conventional lenses.

537.533.75 : 539.163.2 = 3 *see Abstr.* 2660

537.533.8 : 621.385.1.032.216 2619

Secondary electron emission from oxide-coated cathodes. POMERANTZ, M. A. *J. Franklin Inst.*, **241**, 415–34 (*June*, 1946). *Phys. Rev.*, **70**, 33–40 (*July* 1 and 15, 1946).—[Abstr. 2382 B (1946)].

537.542 2620

The construction of countertubes. DE VRIES, H. *Physica, 's Grav.*, **11**, 433–40 (*Feb.*, 1946).—A survey is given of failures of counter tubes, confined to counters containing some alcoholic vapour. It is shown that so-called after-discharges are caused by processes on the surface of the wall of the tube, after the impact of the positive ions. Failures are described that are caused by processes on the surface of the cathode; it is shown that Al cathodes can be used. Finally some constructions are described and the failures that may arise.

537.542 : 539.16.08 2621

Measurements on self-quenching Geiger-Müller counters. VAN GEMERT, A. G. M., DEN HARTOG, H., AND MULLER, F. A. *Physica, 's Grav.*, **9**, 556–64 (*June*, 1942).—Experiments with self-quenching counters containing alcohol and argon are described. Current-time characteristics are discussed. While the pulses appear to give identical cathode-ray oscillograms when the counter wire is earthed through a large resistance and capacitor, they are actually far from being the same. It is probable that photons play an important part in the axial propagation of the discharge, and also influence to a substantial degree the radial propagation. The space-charge theory is inadequate for the description of the specific properties of counters containing vapours, and it should be supplemented by taking into account the photoelectric absorption of photons arising from the anode region. A. J. M.

537.542 : 539.16.08 *see Abstr.* 2653

537.542 : 578.088.5 : 539.16.08 *see Abstr.* 2654

537.565 = 4 2622

Determination of mobilities of large ions in a gas at rest. VASSAILS, G. *C.R. Acad. Sci., Paris*, **222**, 724–5 (*March* 25, 1946) *In French.*—The application of an electric field to a gas containing large ions results in an ionization current which is at first relatively large, but which gradually decreases as the ions are removed until the small constant value characteristic of spon-

taneous ionization is reached. The minimum mobility and mean mobility of the ions can be obtained from the ionization current/time curve. When there are several different mobilities, the curve descends in a series of steps. In the calculation, the ions are supposed to be dilute, and their weight and diffusion are neglected. Values for the mean mobility of large ions in air produced by ultra-violet light are given.

A. J. M.

537.568 : 621.396.11 : 621.396.821 : 551.510.535 *see Abstr.* 2702

537.591 2623

Production of mesotrons in the stratosphere. Bloch, I. *Phys. Rev.*, **69**, 575–84 (*June* 1 *and* 15, 1946).—The intensity of the vertically moving ionizing penetrating cosmic-ray particles in the stratosphere is derived as a function of altitude, magnetic latitude and energy, on the assumption that all the cosmic-ray mesotrons have the same mean life at rest of $2{\cdot}15\ \mu$sec and are produced, 9 at a time, by primary protons in the fields of air nuclei, that the cross-section of an air nucleus for mesotron production by a proton is independent of the proton's energy and is equal to $2{\cdot}5\times10^{-25}$ cm^2 and that the kinetic energy of a primary proton is divided equally among the total energies of the mesotrons it produces. Comparison of theory and experiment shows that the multiplicity of mesotron production by protons is approximately 9 for proton energies $> 7\times10^9$ eV, for a differential energy spectrum of protons, of the form $N_0E^{-2\cdot9}$, that for proton energies $< 7\times10^9$ eV the multiplicity of mesotron production is < 9 and the power law energy spectrum is modified, that mesotrons with mean lifetimes $\ll 2{\cdot}15\times10^{-6}$ sec probably must be postulated to account for the soft component in the stratosphere, and that, as mesotrons are produced, nuclear particles are knocked forward, taking a small fraction of the available energy.

537.591.08 : 551.508.11 2624

New cosmic ray radiosonde techniques. Korff, S. A., and Hamermesh, B. *J. Franklin Inst.*, **241**, 355–368 (*May*, 1946).—An airborne radio transmitter is described, adapted in this instance to the measurement of the energy distribution of neutrons produced by cosmic radiation in the free atmosphere, but also capable of measuring and transmitting solar u.v., O_2, ionization, temperature, pressure, humidity, conductivity, etc. Lifting is accomplished by a flight of 67 small balloons giving a gross lift of 174 lb, and with 119 lb of apparatus a net lift of 55 lb. An oscillator transmits a series of dots, dashes, etc., in a code and keying is carried out by interrupting the transmission; in this case the neutron counter, with its amplifier, sends pulses to the oscillator grid which stop it radiating. 3 shields cover the counters in turn and so give energy distribution, compared with the unshielded counter. Pressure and temperature are also transmitted. The receiver comprises a relay-recorder. Flights are described, with results. Circuit details are given.

E. H. W. B.

537.591.15 = 4 2625

Auger bursts. Rogozinski, A. *Ann. Phys., Paris*, **20**, 392–452 (*July–Aug.*, 1945) *In French.*—The apparatus consisted of many counters which, for recording purposes, may be divided into three groups: firstly, a set arranged to count coincidences; secondly, a set in anti-coincidence with the first group; and thirdly a number of counters whose individual impulses are recorded separately on photographic paper together with those of the coincidence and anti-coincidence groups. The counters of this ensemble have been disposed in a variety of ways, the chief purpose being to detect and make measurements on the penetrating particles accompanying Auger bursts. The work was carried out at two different altitudes, viz., 180 m and 3 240 m. The conclusions arrived at were: (1) that penetrating particles, probably mesons, existed in the body of the shower, passing through Pb sufficiently thick to absorb all the shower particles; (2) that coincidences were obtained between such particles when the detecting counters were separated by 20 m in a horizontal direction, and even by as much as 50 m at the higher altitude. In order to decide whether these penetrating particles were an integral part of the shower or merely isolated mesons accompanied by their secondary electrons, certain theoretical points had to be considered which are detailed in the paper. Comparing these theoretical results with experiment led to the conclusion that only a small fraction of these penetrating particles could be considered as isolated events, the majority being part of the shower.

W. E. D.

537.591.5 = 5 2626

Effect of meteorological changes on the intensity of meson radiation. Cacciapuoti, B. N. *Nuovo Cim.*, **19**, 99–108 (*March*, 1942) *In Italian.*—The mean life of the meson was determined at 3 480 m above sea-level as a function of pressure and temperature changes at the observation post.

537.591.5 2627

Solar and sidereal diurnal variations of cosmic rays. Duperier, A. *Nature, Lond.*, **158**, 196 (*Aug.* 10, 1946).—The amplitude and time of maximum, corrected for atmospheric temperature changes of the variations of cosmic ray intensity are given for six periods throughout the year. On the assumption that the solar variation alters only in amplitude and not in phase, the existence of a sidereal variation is demonstrated. The possibilities of solar and stellar emission of cosmic rays is discussed.

537.591.8 2628

Cascade showers under thin layers of materials. Chakrabarty, S. K. *Nature, Lond.*, **158**, 166 (*Aug.* 3, 1946).—Earlier work [Abstr. 1976 (1943)] is extended to include integration for all values of thickness and particle energy. The values $N(t)$ of the total number of particles at depth t are given for some values of thickness and primary energy [see also Abstr. 67, 2340 (1945)].

537.591.8 : 539.172 = 3 *see Abstr.* 2665, 2666

537.722 2629

Measurement of surface potential or contact potential differences. Frost, A. A. *Rev. Sci. Instrum.*, **17**, 266–8 (*July*, 1946).—A modified Kelvin method, making use of a *p*H meter of type commonly found in chemical and biological laboratories, is described. [See Abstr. 1337 (1946)].

538.11 : 531.19 2630

On the statistical mechanics in a magnetic field. Broer, L. J. F. *Physica, 's Grav.*, **12**, 49–60 (*April*,

1946).—The fundamental relations of the statistical mechanics and thermodynamics of magnetized matter are derived in a systematic way, starting from the most general form of the Lagrangian of matter and magnet. The Hamilton equations of the matter alone are established by means of the Routh function. The well-known fact that the corresponding Hamilton function instead of the total energy of the matter must be used in the partition function is rigorously proved. A comparison is made between the various quantities of energy which enter in the processes of magnetization and electric polarization respectively.

538.113 2631

On the theory of paramagnetic relaxation. BROER, L. J. F. *Physica, 's Grav.*, **10**, 801–16 (*Dec.*, 1943).—Spin- and lattice-relaxation are discussed and spin-absorption is studied in these cases: (1) a system without crystalline and magnetic fields; (2) a system without crystalline fields but with magnetic fields. The effect of crystalline fields is then investigated. These fields remove the degeneracy completely. It is found that the spin relaxation time is always small enough to justify the use of the thermodynamic relaxation theory of Casimir and Du Pré [Abstr. 3855 (1938)]. It is argued that a former theory [Abstr. 3396 (1938)] is invalid. L. S. G.

538.214 2632

On the high frequency rest-susceptibility of chromium-alum. BROER, L. J. F. *Physica, 's Grav.*, **9**, 547–55 (*June*, 1942).—Calculations are made on the two assumptions that the spin-system does and does not reach internal thermodynamical equilibrium. Theoretical arguments are given for the latter.

538.222.029.63 2633

Paramagnetic absorption at radio frequencies in gadolinium sulphate octohydrate. DE VRIJER, F. W., VOLGER, J., AND GORTER, C. J. *Physica, 's Grav.*, **11**, 412–18 (*Feb.*, 1946).—Studies were made at 77°K and at 90°K, and the results are given in tables and figures. A few results are also given of the absorption in a perpendicular constant field.

538.24 2634

Theory of long period magnetic relaxation. KITTEL, C. *Phys. Rev.*, **69**, 640–4 (*June* 1 *and* 15, 1946).—A discussion is given of the long period changes in magnetization in a mild steel specimen subjected to alternating stresses while in a weak magnetic field. The magnetization changes appear to occur with two time constants, of the order of 3 months and 5 years. A formal treatment of the phenomena is given along the lines of the time-dependent barrier potential used by Snoek [Abstr. 4237 (1938)] in discussing other magnetic relaxation processes. The increase in the potential barrier is pictured as caused by the mechanical relaxation of local strains.

538.24 : 621.317.44 2635

Some uses of the magnetic potentiometer for the determination of magnetization curves upon open-circuited specimens. MARGERISON, T. A., AND SUCKSMITH, W. *J. Sci. Instrum.*, **23**, 182–4 (*Aug.*, 1946).—[Abstr. 2330 B (1946)].

538.242 = 4 2636

Magnetization of a ferromagnetic metal under a shear within the limits of Hooke's law. FRANÇOIS, G. *Bull. Soc. Belge. Élect.*, **62**, 1–6 (*Jan.–March*, 1946) *In French.*—The theory of Becker supposes a crystal of ferromagnetic material to consist of magnetic dipoles mainly aligned in the favoured 100, 010 and 001 directions of a cubic lattice, and expressions are derived for the potential energy in a magnetic field. Magnetization curves are briefly considered and the theory is then extended to magnetostriction and the case of a simple shear. The crystallographic, magnetic and elastic hypotheses lead to the result that a simple shear has less effect on the magnetic susceptibility than a direct tension or compression. It is suggested that a revolving shaft would be a suitable subject for testing the theory as an axial field should be developed by the shear involved. E. H. D.

538.245 = 4 2637

Magnetic properties of manganese nitrides. GUILLAUD, C., AND WYART, J. *C.R. Acad. Sci., Paris*, **222**, 71–3 (*Jan.* 2, 1946) *In French.*—The magnetic moment of the Mn atom in the ε phase increases non-linearly from 0·42 Bohr magnetons at 11·5 atomic % N to 1·42 at 21·5%. The Curie temperature decreases from 485° to 460°c in the same range. The α phase (<1·6 atomic % N) and the ξ phase (Mn_5N_2 approx.) are non-magnetic. A. J. C. W.

538.245 : 548.73 : 669.526.777 = 4 2638

Ferromagnetic properties of the compound CrTe. GUILLAUD, C., AND BARBEZAT, S. *C.R. Acad. Sci., Paris*, **222**, 386–8 (*Feb.* 11, 1946) *In French.*—Alloys of Cr and Te formed by heating the powdered elements in argon at 1 200°c are most magnetic at the composition CrTe. The moment of the Cr atom is 2·39 Bohr magnetons, and the Curie point is 66°c. X-ray investigation confirms that CrTe has the hexagonal NiAs structure with $a = 3{\cdot}98$ A, $c = 6{\cdot}21$ A, $c/a = 1{\cdot}56$. Both X-ray and magnetic evidence indicate that CrTe does not dissolve excess Cr. A. J. C. W.

538.566.5 : 621.392.2 = 4 2639

On the propagation of electromagnetic waves in curved hollow guides. JOUGUET, M. *C.R. Acad. Sci., Paris*, **222**, 440–2 (*Feb.* 18); 537–8 (*March* 4, 1946) *In French.*—[Abstr. 2402 B (1946)].

538.615 : 535.338.1 *see Abstr.* 2553

538.691 : 621.385.83 2640

A graphical method for determining particle trajectories. PARKINS, W. E., AND CRITTENDEN, E. C., JR. *J. Appl. Phys.*, **17**, 447–9 (*June*, 1946).—[Abstr. 2393 B (1946)].

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539.132 : 535.343.31 : 535.338.4 *see Abstr.* 2558

539.132 : 535.375.5 : 548.7 = 4 2641

Theoretical study of the vibration spectrum of natural orthorhombic sulphates. COUTURE, L. *C.R. Acad. Sci., Paris*, **222**, 388–90 (*Feb.* 11, 1946) *In French.*—The free SO_4 ion has four vibration frequencies, one simple, one doubly, and two triply, degenerate. In crystals each frequency is split into four by coupling, and the degeneracy is removed. Some of the 36 frequencies are active in the Raman effect, others in the infra-red. It can be shown that the intensity of one is theoretically zero, and of others is very small. A. J. C. W.

539.152 2642

A new method of determining electronegativity from other atomic properties. GORDY, W. *Phys. Rev.*, **69**, 604–7 (*June* 1 *and* 15, 1946).—The relation, $\chi = 0{\cdot}31(n+1)r^{-1} + 0{\cdot}50$, where χ represents the electronegativity of an atom according to Pauling's revised scale, n the number of electrons in its incompletely filled (valence) shells, and r its single bond covalent radius measured in Å, has been found valid for all elements having χ values available for comparison, except for Ag, Au and Cu. This equation is used to extend the electronegativity scale to include a total of 52 elements. A chart is constructed to demonstrate the systematic relation of the values to the periodic table. Beginning with the definition of the electronegativity of a neutral atom in a stable molecule as the potential at a distance r (covalent radius) from its nucleus which is caused by the nuclear charge effective at that distance, a simple theoretical justification is offered for the existence of a linear relation between χ and $(n+1)/r$. This relation, like Mulliken's, provides an "absolute" scale of electronegativity values.

539.152.1 2643

Note on the lifetime of metastable states. WIEDENBECK, M. L. *Phys. Rev.*, **69**, 567–9 (*June* 1 *and* 15, 1946).—The available data on approximately forty γ-emitting metastable states of isomeric nuclei has been compared with the present theories. Nearly all of the points lie near two straight lines when $\log\lambda\,(\sec^{-1})$ is plotted against $\log E$. These lines fall close to the theoretical curves of Bethe calculated for electric 2^4 and 2^5 pole radiation.

539.152.1 2644

The magnetic moments of light nuclei. SACHS, R. G. *Phys. Rev.*, **69**, 611–15 (*June* 1 *and* 15, 1946).—The sum of the magnetic moments of two nuclei which can be obtained from each other by interchanging neutrons and protons is shown to be related in a simple way to the probabilities of occurrence of each of the states of given spin and orbital angular momentum that can be combined to form the ground state. This result, which is independent of any nuclear model, has immediate application to the nuclei with equal numbers of neutrons and protons, in particular, to H^2, Li^6, B^{10} and N^{14}. From the observed moments it is found that the ground state of B^{10} is a combination of about 50% ^3S and 50% ^3D function, and information of a similar kind is given for Li^6 and N^{14}. All of these results are based on the assumption that the only terms contributing appreciably to the ground states of the nuclei are those found to be near the ground state in the Hartree approximation. It will be possible to obtain similar information concerning the ground states of other light nuclei if a technique for measuring the magnetic moments of radioactive nuclei is developed.

539.152.1 : 537.123 = 4 *see Abstr.* 2594

539.152.2 2645

Negative result of an attempt to observe nuclear magnetic resonance in solids. GORTER, C. J., AND BROER, L. J. F. *Physica, 's Grav.*, **9**, 591–6 (*June*, 1942).—It was hoped to observe nuclear magnetic spins by making use of abnormal dispersion in the ordinary short-wave band. The negative result is attributed to the lack of interaction between the nuclear spins and the thermal waves of the crystalline lattice.

539.152.2 2646

Relativistic correction in calculating the magnetic moment of the deuteron. CALDIROLA, P. *Phys. Rev.*, **69**, 608–10 (*June* 1 *and* 15, 1946).—This paper presents a study of the variation in the magnetic moment of protons and neutrons caused by their kinetic energy; it assumes that these particles satisfy the relativistic Dirac–Pauli equation, which is characteristic of a particle with spin $\frac{1}{2}$, and that the particles possess a supplementary magnetic moment (not depending on charge). An hypothesis, formulated by Margenau about the variation law for magnetic moments [Abstr. 1649 (1940)], and the effect of the relativistic correction in calculating the deuteron magnetic moment are discussed.

539.153 : 535.33 2647

Configurations with *f*-electrons. SCHUURMANS, P. *Physica, 's Grav.*, **11**, 475–80 (*March*, 1946).—The energies of the terms with large L and S values are calculated for configurations with f and d electrons. These formulae are of use in the analsyis of the spectra of Th and U. The configurations f^x are partially calculated. The distances between the multiplets of high multiplicity can be expressed in one parameter $(5F_2 + 6F_4 - 91F_6)$. By using the analogy with the configurations d^x, the grouping of the terms at the point of degeneracy is given.

539.153.4 : 523.872 : 537.228.5 *see Abstr.* 2601

539.155.2 2648

Isotopic constitution of tellurium, silicon, tungsten, molybdenum, and bromine. WILLIAMS, D., AND YUSTER, P. *Phys. Rev.*, **69**, 556–67 (*June* 1 *and* 15, 1946).—The relative abundances have been redetermined by means of a mass spectrograph of the Nier type. The results are given in tables and graphs of mass spectra, together with the values of the chemical atomic weight.

539.155.2 : 533.15 2649

Partial separation of the oxygen isotopes by thermal diffusion and the deuteron bombardment of O^{17}. WELLES, S. B. *Phys. Rev.*, **69**, 586–9 (*June* 1 *and* 15, 1946).—With an 18 m column, O^{18} has been enriched from the ordinary concentration of 0·2% to 17% and O^{17} from 0·04% to 0·8%. The former increase was determined by the mass spectrometer, the latter by the increased activity of F^{18} produced in the nuclear reaction O^{17} $(d, n)F^{18}$. The time rate of increase of the concentration of O^{18} was characterized by a step-wise nature, which arises from the staggering of the six 3 m tubes convectively coupled in series. A qualitative discussion of staggering is given.

539.155.2 : 533.15 *see Abstr.* 2520

539.155.2 : 542.48 *see Abstr.* 2689

539.157 : 535.354 = 4 2650

Calculation of the mean life of the 3^2P state of the sodium atom. DUPUY, G. *C.R. Acad. Sci., Paris*, **222**, 654–6 (*March* 18, 1946) *In French.*—The life is calculated in terms of the probabilities A_1 of the atom returning directly to the ground state, A_2 of returning through the 2^2S and 2^2P states, and A_3 of returning through the 3^2D and 2^2P states. The value of

$(A_2 + A_3)/A_1$ is taken from experimental data, while that of A_1 is obtained theoretically, resulting in a mean life of $1 \cdot 2 \times 10^{-7}$ sec. W. E. D.

539.16 : 615.849.7 2651

Protection methods of lead shielded radium. Brabstrup, C. B. *Radiology*, **46**, 385–90 (*April*, 1946). In most methods of protective value measurements a narrow beam is employed, with application of the inverse square law. In practical applications, however, the radiation beam is usually wide, with resulting increase of the scattered radiation component, so that the inverse square law is not predominant. Apparatus is described by which comparative measurements are made under given conditions for narrow and wide beams. Manipulations in the preparation of radium or radon applications are usually carried out behind L-shaped blocks of lead. This reduces materially the direct radiation received by the operator but the indirect scattered radiation received may still be considerable. Experiments carried out show that greater protection can be attained by conducting these operations far from walls, etc., so decreasing the scattered component received by the operator, as well as by reducing the cross section of the beam of radiation. B. J. L.

539.16.08 2652

An automatic sample changer to be used for measuring radioactive samples. Peacock, W. C., and Good, W. M. *Rev. Sci. Instrum.*, **17**, 255–61 (*July*, 1946).

539.16.08 : 537.523.4 = 3 *see Abstr.* 2610

539.16.08 : 537.542 2653

Design of beta-ray and gamma-ray Geiger–Müller counters. Good, W., Kip, A., and Brown, S. *Rev. Sci. Instrum.*, **17**, 262–5 (*July*, 1946).—This paper describes 3 types of counters which have proved particularly useful in the laboratory. These are the mica window bell-type β-counter, a modified bell-counter used as an X-ray counter, and a high sensitivity Bi screen γ-counter of conventional design.

539.16.08 : 537.542 *see Abstr.* 2621

539.16.08 : 578.088.5 : 537.542 2654

Small mica window Geiger–Müller counter for measurement of radioactive isotopes *in vivo*. Strajman, E. *Rev. Sci. Instrum.*, **17**, 232–4 (*June*, 1946).

539.16.081.1 2655

New units for the measurement of radioactivity. Condon, E. U., and Curtiss, L. F. *Phys. Rev.*, **69**, 672–3 (*June* 1 *and* 15, 1946).—A new unit, the "rutherford," whose value is 10^6 disintegrations/sec, is recommended by the U.S. National Bureau of Standards for use in designating the strength of radioactive sources. For the measurement of γ-ray sources, the "Roentgen/hour at 1 metre" is recommended, abbreviated to "rhm."

539.162 2656

Nuclear energetics and β-activity. Saha, M. N., and Saha, A. K. *Trans. Nat. Inst. Sci., India*, **2**, 193 (1946). *See also Nature, Lond.*, **158**, 6–9 (*July* 6, 1946).—The formula for nuclear mass defect contains spin-independent and spin-dependent terms, for only the former of which are theoretical expressions available (Weizsäcker–Bethe). Some general considerations concerning the variation of the spin-dependent terms with mass number and isotope number (neutrons minus protons) can be laid down for certain classes of nuclei, and the bearing of these on rules for nuclear stability are discussed. An estimate is made of the order of value of the spin-dependent terms, and some predictions of radioactive phenomena are made on the basis of the calculations.

539.163 = 3 2657

Disintegration of *UZ* and the UX_2–*UZ* isomerism. Bradt, H., and Scherrer, P. *Helv. Phys. Acta*, **18** (*No.* 5) 405–29 (1945) *In German.*—The β-spectrum of *UZ* has been investigated and the upper limit of the stronger soft partial spectrum has been found to be $0 \cdot 45 \pm 0 \cdot 03$ eMV. β-γ coincidence determinations give $1 \cdot 8 \pm 0 \cdot 2$ quanta per disintegration for the absolute intensity of the $0 \cdot 8$ eMV γ-radiation of *UZ*. There appears to be no directional correlation of two quanta emitted successively in the principal disintegration of *UZ*. The radiation from *UZ* agrees with the scheme put forward by Feather and Bretscher and shows that UX_2 is the excited metastable state and *UZ* the ground state of Pa^{234}. In the β-spectrum of *UX* two very weak β-lines were detected at 372 and 387 ekV. These are to be regarded as *L* and *M* conversion lines of a γ-radiation of energy $(0 \cdot 394 \pm 0 \cdot 005)$ eMV, emitted by UX_2. By the emission of this radiation the UX_2 passes in 0·15% of all cases into the ground state *UZ*. The observed life period of UX_2 is in good agreement with the value calculated assuming a rotational impulse difference $I_{UZ} - I_{UX_2}$ of $5\hbar$, and an excitation energy $E_{UX_2} - E_{UZ}$ of $0 \cdot 394$ eMV. A. J. M.

539.163 2658

Radioactivity of samarium. Cuer, P., and Lattes, C. M. G. *Nature, Lond.*, **158**, 197–8 (*Aug.* 10, 1946).—The long-range radiation previously reported for Sm [Abstr. 934 (1936), 2827 (1934)] has been investigated using the new photographic emulsion [Abstr. 1925 (1946)]. It is attributed to α-particles of 3·9 cm range in air, which do not originate in the Sm. Since this is nearly the range for Po α-particles, they may be due to contamination by Po, though this is not considered likely. A second alternative is a small amount of element 61 with a shorter decay period, which would also account for the similar long-range activity observed with a Nd sample. The decay period of short-range Sm activity was determined to be $(1 \cdot 3 \pm 0 \cdot 1) \times 10^{11}$ years.

539.163 : 620.179.152 : 778.33 2659

Radon. Its properties and preparation for industrial radiography. Dawson, J. A. T. *J. Sci. Instrum.*, **23**, 138–44 (*July*, 1946).—A review. Rn can be used effectively in place of Ra for industrial γ-radiography. The decay properties of Rn are considered. The extraction of Rn from Ra, the purification of the gas, and a new type of extraction plant in which the gas from a Ra solution is drawn continuously at a slow rate through a tube immersed in liquid O_2, are described. A. J. M.

539.163.2 : 537.533.75 = 3 2660

Simple absorption method for determining the energy of weak β-spectra. Huber, O., Lienhard, O., Scherrer, P., and Wäffler, H. *Helv. Phys. Acta*, **18** (*No.* 3) 221–5 (1945) *In German.*—Methods of determining the maximum energy of β-rays from

radioactive isotopes are outlined. They all apply to thin layers, whereas for the production of radioactive isotopes by means of γ-rays or neutrons, the preparations are irradiated in thick layers, and the usual methods do not give accurate results. The blackening curve of some β-ray emitters has been determined with an Al absorber, and the $\frac{1}{2}$-value thickness of the absorber has been found. There is a linear relationship between the $\frac{1}{2}$-value thickness and the maximum β-ray energy. This curve can then be used to determine β-ray intensities. The method gives accurate results if the β-ray spectrum is simple. If there are two spectra, the value obtained lies between the maxima of the two. In general, the method gives the lower limit of the energy liberated in a β-ray disintegration.

A. J. M.

539.165 2661

The β-radiations of uranium X_1. JNANANANDA, S. *Phys. Rev.*, **69**, 570–4 (*June* 1 *and* 15, 1946).—An investigation of the distribution with momentum has been made by analysis with the magnetic electron lens spectrometer between $H\rho < 650$ and $H\rho > 1\,875$. The lower limit of the range is limited by the window of the detecting device. There is clear evidence of 3 distinct peaks, which represent 3 groups of β-rays due to internal conversion. The energy values agree with those obtained by Meitner. The end point of the continuous spectrum is at $H\rho$ 1 617 (189·9 ekV), a value which agrees with that obtained by absorption but differs considerably from Marshall's value obtained with the expansion chamber [Abstr. 2528 (1937)]. The present value, unlike that of Marshall, gives a point on the Sargent diagram [Abstr. 2326 (1933)] nearly on the curve of allowed transitions.

539.165 : 537.531 2662

Characteristic X-rays excited by beta-particles. EDWARDS, J. E., AND POOL, M. L. *Phys. Rev.*, **69**, 549–55 (*June* 1 *and* 15, 1946).—Characteristic X-rays have been shown to be associated with a β-particle source. The X-rays excited in atoms outside the β-emitting atom were detected by absorption measurements and photographically, with a curved crystal spectrograph. Characteristic Cu X-rays associated with the decay of 12·8-hour Cu^{64} are attributed to the strong β-activity of the source. Photographs of characteristic X-rays excited by P^{32} β-particles in Cu, Zr, Rh and Ag were obtained. The characteristic X-rays and general X-radiation excited by P^{32} β-particles in Al, Cu, Ag, Sn and Pb were studied by absorption of the radiation in Al, Cu and Pb.

539.167.3 : 551.510.41 2663

Atmospheric helium three and radiocarbon from cosmic radiation. LIBBY, W. F. *Phys. Rev.*, **69**, 671–2 (*June* 1 *and* 15, 1946).—The known greater abundance of He^3 in the atmosphere compared with gas well helium can be ascribed to the accumulation of the decay product of H^3 formed by collision of energetic neutrons with N^{14}. The majority of cosmic ray neutrons, however, will form C^{14} which, with a half-life $\geqslant 10^3$ yr, is likely to be present in all carbonaceous matter on the surface of the earth. An estimate of the equilibrium amount thus present indicates that it may be just measurable.

539.169 : 621.319.35 2664

A new type of electrostatic generator. MILLER, P. H. *Phys. Rev.*, **69**, 666 (*June* 1 *and* 15, 1946).—One gram of Po emitting 5·3 eMV α-particles would charge an isolated metal shield to 2 MV and provide a steady current of 25 μA. A possibly economic source of Po is suggested by the action of neutrons on Bi. If Bi were used instead of water to cool a 10^6 kW chain-reacting pile, 0·1 g per day of Po should be produced.

539.172 : 537.591.8 = 3 2665

Nuclear disintegration in a photographic emulsion by cosmic rays. WAMBACHER, H. *S.B. Akad. Wiss. Wien*, **149**, 2*a* (*Nos.* 3–4) 157–212 (1940) *In German.*—Plates with 2–14 stars were obtained. The largest observed excitation energy was approximately 670 eMV. The energy of the individual liberated particles varies with excitation energy. The variation of the number of particles and the energies of stars with height has been studied. A summary of reported cases of disintegration stars in the cloud chamber is given.

A. J. M.

539.172 : 537.591.8 = 3 2666

Nuclear disintegration in photographic films caused by cosmic rays. ORTNER, G. *S.B. Akad. Wiss. Wien*, **149**, 2*a* (*Nos.* 5–6) 231–58 (1940) *In German.*—The nuclear disintegration produced by cosmic ray particles discovered by Wambacher [Abstr. 2665 (1946)] is discussed. The behaviour of high-energy protons is shown to be in accordance with Heisenberg's theory of the interaction of highly energized particles with atomic nuclei. The range of action of the nuclear forces should be about 0·7× the radius of the electron. The large number of protons with energies <10 eMV points to a break-up of the nucleus into smaller fragments.

539.172.4 2667

On the activities caused by nearly thermal neutrons. DIEMER, G., AND DE VRIES, H. *Physica, 's Grav.*, **11**, 345–52 (*Feb.*, 1946).—It is generally assumed that the neutrons transmitted by Cd only contribute to the resonance activity. It is shown that, in fact, the contribution of the neutrons with energies between the Cd cut-off E_l and the resonance energy E_r is very small when only one level plays a part and $E_r \gg E_{th}$ ($E_l = 0{\cdot}50$ eV calculated from the absorption curve of Cd). This does not hold, however, when K_{th}, the absorption coefficient for thermal neutrons, is larger than follows from the one level formula. [See Abstr. 1541 (1945)]. A method is described for the measurement of the activity B_{nl} caused by neutrons with energies just above E_l ("nearly thermal neutrons"). Corrections for B_{nl} are very important for investigations on resonance neutrons.

539.172.4 2668

Some measurements on the 66 hour period of gold. DIEMER, G., AND GROENDIJK, H. *Physica, 's Grav.*, **11**, 396–400 (*Feb.*, 1946).—By means of the boron absorption method it is shown that the resonance activity of the 66 hr period of Au must be ascribed to at least 2 groups of neutrons, one with an energy of 1·8 eV and the other probably corresponding to several resonance levels with an average energy of about 50 eV.

539.172.4 2669

Fission products of U^{235}. GRUMMITT, W. E., AND

WILKINSON, G. *Nature, Lond.*, **158**, 163 (*Aug.* 3, 1946).—The fission yield of a fission isotope is the probability of the isotope being formed by thermal neutron fission. Methods of determining this value are briefly outlined and some results quoted. The log of the fission yield is plotted against mass number on a graph for 22 isotopes, and the values fall on two symmetrical curves, centred on mass number 117, with peaks at 96 and 138. The sum of the maxima is 234, indicating that 1–3 secondary neutrons are emitted per fission. The total for each group is 0·9, but the divergence from unity is probably due to a low value for the reference yield of Ba^{140}. The greater part of the heavy group lies in the rare earth region. Several previously unreported isotopes are listed, with their activities.

539.185 2670

Further experiments upon the scattering of silver 22 sec resonance neutrons. DIEMER, G. *Physica, 's Grav.*, **11**, 481–94 (*March*, 1946).—The Ag^{110} 22 sec period has now been examined experimentally by means of the new method for determining the width and the shape of resonance levels [Abstr. 1542 (1945)]. The theory of this method has been worked out more extensively. The experimental results for the Ag 22 sec level are in better agreement with the one-level formula of Breit–Wigner, than with a Gauss-curve. A level width $\Gamma_{eff} = 0{\cdot}9$ eV ($\pm 0{\cdot}05$ eV) has been derived, in accordance with former measurements. Values are quoted for the scattering cross-section of these 8·2 eV neutrons for C, Al, Si, S, Fe, Zn, Cd, Sn and Pb. The conclusion is that σ_s does not seem to be a monotonic function of the atomic weight and (in comparing the values now obtained with former measurements) we must conclude that σ_s practically does not vary with the energy in the region $E_{th} - 200$ eV.

539.185.7 2671

Overlapping measurements on Cd-resonance neutrons. DIEMER, G. *Physica, 's Grav.*, **11**, 391–5 (*Feb.*, 1946).—Absorption measurements were made on Cd and Cu resonance neutrons. By performing the different mutual absorption measurements it could be shown that the Cd^{116} isotope (giving rise to the 4 hr period) is responsible for the overlapping of Cu and Cd levels reported earlier [Abstr. 1542, 1543 (1945)]. It is probable that all of the width of the level is due to Doppler broadening, which at this energy ($E_r \approx 135$ eV) is $\Delta = 1$ eV. Thermal neutrons do not contribute much to the activity of 4 hr Cd.

539.185.7 2672

Absorption of slow neutrons by Cd^{113}. MOYER, B. J., PETERS, B., AND SCHMIDT, F. H. *Phys. Rev.*, **69**, 666 (*June* 1 *and* 15, 1946).—Measurements on isotopes of Cd separated by a mass spectrograph indicate that Cd^{113} is alone responsible for the large absorption of thermal neutrons.

STRUCTURE OF SOLIDS 539.2

539.217.3 : 679.5 : 621.315.616.9 2673

Effect of moulded skin on the water absorption of hard composite dielectrics. *Rep. Brit. Elect. Allied Industr. Res. Ass., Ref. B/T*31, 9 *pp.* (1942).—[Abstr. 2297 B (1946)].

539.233 : 621.315.61.017.142 : 541.183.55 *see Abstr.* 2687

ELASTICITY . STRENGTH . RHEOLOGY 539.3/.8

539.32 : 534.321.9 *see Abstr.* 2531

539.32 : 536.413.3 *see Abstr.* 2583

539.37 = 4 2674

On the formula for the energy of deformation in the case of finite deformations. BERGEOT, P. *C.R. Acad. Sci., Paris*, **218**, 824–25 (*May* 22, 1944) *In French.*—The integral formula for the energy is deduced in a special case where a system of constraints is defined in the deformed medium. L. S. G.

539.373 = 4 2675

The dynamic elastic limit and its relations to the structural states of a metal. FOTIADI, A. *C.R. Acad. Sci., Paris*, **222**, 475–6 (*Feb.* 25, 1946) *In French.*—Specimens subjected to alternating torsion or flexure at 50 c/s show evolution of heat, increase of deformation and diminution of transmitted couple when the surface stress exceeds a certain amount, the same for all three phenomena, called the *dynamic elastic limit*. For homogeneous specimens the limit (in kg/mm²) is proportional to the Vickers hardness and the breaking strength, with proportionality factors 0·1 and 0·32 in torsion and 0·175 and 0·56 in flexure respectively. For inhomogeneous (for example 2-phase or case-hardened) specimens it is always less than the values given by these factors. A. J. C. W.

539.373 2676

"Plastic" transverse contraction of a longitudinally strained metal. SWAINGER, K. H. *Nature, Lond.*, **158**, 165 (*Aug.* 3, 1946).—The "plastic" strain of a specimen under simple tensile loading is the part which does not disappear when the load is removed [Abstr. 1704 (1946)]. The ratio transverse/longitudinal plastic strain, previously estimated at 0·5, was measured for duralumin. It reached a value 0·42 at the corner of the stress/strain curve and then fell to a constant value 0·37. This value indicates that volume changes occur in the plastic component of the strain as well as the elastic part.

539.374 : 669.71 = 3 2677

Investigations on the rapid deformation of aluminium. KISTLER, W. *Schweiz. Arch. angew. Wiss. Tech.*, **12**, 169–76 (*June*, 1946) *In German.*—In very rapid deformation, such as cold-extrusion of tubes, Al shows an extraordinary plasticity, flowing almost like a liquid ("Kaltspritzverfahren"). X-ray examination shows that the glide planes and glide directions are the same as in slow deformation, resulting in a fibre structure with [112] along the tube axis and (110) tangent to the tube wall. The externally-measured plastic deformation a^* is proportional to the mean plastic deformation of the crystallites $\bar{a}$; the factor can be obtained from the yield stresses of single crystals and of polycrystalline aggregates, or from the strain hardenings. Both methods give $a^* = 0{\cdot}08\,\bar{a}$ for Al. The process is discussed in terms of Becker's theory [Abstr. 1204 (1926)], and the increase in plasticity is attributed to heating up during rapid deformation. A. J. C. W.

539.377 : 548.0 : 536.413 2678

The plastic deformation of non-cubic metals by heating and cooling. Boas, W., and Honeycombe, R. W. K. *Proc. Roy. Soc. A*, **186**, 57–71 (*June* 4, 1946).—Small steel cylinders coated on the inside with Sn-base and Pb-base bearing alloys were heated and cooled by immersion in oil. After a few cycles between 30° and 150°c cracking was noticed on the surface of the Sn-base bearing but the Pb-base bearing was unchanged, even after a large number of cycles. It is shown that this plastic deformation in the case of Zn, Cd and Sn is due to the anisotropy of thermal expansion in the crystals of non-cubic metals. In certain metals, grain boundary migration is associated with the deformation. The persistence of the lattice distortions is shown by X-ray photographs and also by recrystallization subsequent to the cyclic treatment. Some possible theoretical and practical implications of the phenomenon are discussed. The order of magnitude of the stresses set up on heating and cooling of non-cubic crystals is estimated. L. S. G.

539.383 = 4 2679

X-ray study of the contact of two spheres. Kammerer, A., and Dickens, J. *C.R. Acad. Sci., Paris*, **222**, 584–5 (*March* 11, 1946) *In French.*—An X-ray method has been used to verify the fact that if two steel spheres are pressed together by an increasing force, the elastic limit is reached and then exceeded at a point within the sphere on the perpendicular from the centre to the surface of contact. The results agree with those obtained by mathematical investigation. A. J. M.

539.4.011.25 2680

A thermodynamic criterion for the fracture of metals. Saibel, E. *Phys. Rev.*, **69**, 667 (*June* 1 *and* 15, 1946).—A theory is proposed on the assumption that the energy required for the abolition of cohesive strength is that fractional part of the energy of fusion which is associated with the change in volume on passing from the solid to the liquid state. This leads to the expression $U = JQ\Delta V/V$ where U is the strain energy per unit volume, J is the mechanical equivalent of heat, Q is the latent heat of melting, V is the molar volume, and Δ refers to the passage from solid to liquid state. Values calculated from this agree with the theoretical values for brittle rupture, and with observed values for cases where plastic flow precedes fracture.

539.4.011.25 : 620.172.224 2681

Failure of ductile metals in tension. Sachs, G., and Lubahn, J. D. *Trans. Amer. Soc. Mech. Engrs*, **68**, 271–6 (*May*, 1946).—[Abstr. 2218 B (1946)].

539.412 : 621.791.056 2682

The inclination of welds to the direction of stress and its influence on tensile strength. Zschokke, H., and Montandon, R. *Brown Boveri Rev.*, **31**, 187–96 (*June*, 1944).—[Abstr. 2471 B (1946)].

539.434 2683

Shrinkage and cracking of cementive materials. *Nature, Lond.*, **158**, 11–14 (*July* 6, 1946).—Report of a symposium held by the Society of Chemical Industry on May 8, 1946.

539.6 : 532.7 = 4 *see Abstr.* 2519

PHYSICAL CHEMISTRY 541

REACTION KINETICS 541.121/.128

541.127.1.08 : 535.33.072 : 531.787.087.44 *see Abstr.* 2494

ELECTROCHEMISTRY 541.13

541.133 = 5 2684

Investigation of the variation of conductance of certain electrolytes upon "T" activation. Calamai, G., and Franzini, T. *Atti Accad. Torino*, **78** (*Tomo I*) 92–8 (1942–1943) *In Italian.*—[See Abstr. 2998 (1939)].

541.133 : 537.311.1 *see Abstr.* 2602

541.135.6 = 4 2685

Discontinuous structure at the boundary between polished metal and electrolyte. Taboury, F. J. *Ann. Phys., Paris*, **16**, 306–97 (*Oct.–Dec.*, 1941) *In French.*—The variations of potential at the boundary of a metallic electrode and electrolyte in a cell are of the form Kv, where v is of the order of 2 mV and K is an integer. This phenomenon has been examined for the case of specially polished metals by electrostatic and electrokinetic measurements, described in detail. The differences of potential are explained by the existence of a zone of discontinuous structure due to the adsorption of polar solvent at the electrolyte in orientated layers of variable density. The paper is illustrated by 20 diagrams, and a very complete bibliography is included. H. H. Ho.

PHOTOCHEMISTRY 541.14

541.14 : 576.8.095.14 *see Abstr.* 2710

COLLOIDS . ADSORPTION 541.18

541.18 : 532.61 *see Abstr.* 2508

541.183.5 : 545.844 2686

Contributions to the theory of chromatography. Glückauf, E. *Proc. Roy. Soc. A*, **186**, 35–57 (*June* 4, 1946).—A mathematical analysis is made of the process of chromatographic separation for two solutes the adsorption of which follows a Langmuir isotherm. Development of the bands is discussed, both with pure solvent and with a solvent containing another solute. Simple conditions are found for both the volume of solvent and the amount of adsorbent required for complete separation of the two solutes. For substances difficult to separate a formula is found for the minimum amount of adsorbent. The case of isotherms other than that of Langmuir is discussed briefly. L. S. G.

541.183.55 : 539.233 : 621.315.61.017.142 2687

The formation of ionized water films on dielectrics under conditions of high humidity. Field, R. F. *J. Appl. Phys.*, **17**, 318–25 (*May*, 1946).—[Abstr. 2292 B (1946)].

CHEMICAL STRUCTURE 541.2/.6

541.6 : 532.61 *see Abstr.* 2510

541.64 2688

Polymers and polymerization. *Nature, Lond.*, **158**, 222–5 (*Aug.* 17, 1946).—A report of a Chemical Society symposium on the subject, April 4, 1946.

541.64 : 535.551 : 532.133 = 393 *see Abstr.* 2500

541.651 : 535.342–31 *see Abstr.* 2561

CHEMICAL PROCESSES APPARATUS 542

542.48 : 539.155.2 2689

A convenient and efficient fractionating column and its use in the separation of the heavy isotopes of hydrogen and oxygen. DOSTROVSKY, I., AND HUGHES, E. D. *Nature, Lond.*, **158**, 164–5 (*Aug.* 3, 1946).

544.1 2690

Elements occupying the position of No. 61. MARSH, J. K. *Nature, Lond.*, **158**, 134–5 (*July* 27, 1946).—This position in the rare-earth series appears to be capable of being filled in various circumstances of solution and precipitation processes by Ac, Th, Bi or Y.

CHEMICAL ANALYSIS 543/545

545.82 : 535.375.5 : 535.33.072 *see Abstr.* 2547

545.822 : 535.243 *see Abstr.* 2541

545.844 : 541.183.5 *see Abstr.* 2686

CRYSTALLOGRAPHY 548

548.0 : 535.66 : 548.24 2691

Crystalline sheen of moonstones. THOSAR, B. V. *Phil. Mag.*, **36**, 719–27 (*Oct.*, 1945).—An experimental study was made of the bluish-white sheen of moonstone crystals. This sheen is due to reflection from a definite plane within the crystal. The polarization characteristics of the reflected sheen were studied and the intensity distribution showed a progressive increase in the reflecting power of the crystal from the red to the blue end of the spectrum. The optical discontinuity giving rise to the reflection of light is attributed to twinning, the whole crystal being composed of a great number of irregular alternations of twinned lamellae. The blue of the sheen is due to the dispersion of the bi-axial indicatrix in the triclinic component of the twin. L. S. G.

548.0 : 536.413 : 539.377 *see Abstr.* 2678

548.0 : 668.1 2692

The crystalline phases of soap. BUERGER, M. J., SMITH, L. B., RYER, F. V., AND SPIKE, J. E. *Proc. Nat. Acad. Sci., Wash.*, **31**, 226–33 (*Aug.*, 1945).—Orthodox methods of producing various soap phases are reviewed and new methods are described. The concepts of descendent phases and phase maps are introduced and some X-ray powder photographs of Na soap phases are reproduced and interpreted. Seven distinct crystalline phases are found. The role of hydration is discussed and the phase map of a certain commercial soap is presented. L. S. G.

548.24 : 535.66 : 548.0 *see Abstr.* 2691

548.572 2693

Topography of crystal faces. BUNN, C. W., AND EMMETT, H. *Nature, Lond.*, **158**, 164 (*Aug.* 3, 1946).—[See Abstr. 1732 (1946)].

548.7 : 535.375.5 : 539.132 = 4 *see Abstr.* 2641

548.7 : 535.375.54 = 4 2694

Raman effect in crystals: pivoting and rotation of molecules in organic crystals. ROUSSET, A. *Ann. Phys., Paris*, **20**, 53–90 (*Jan.–Feb.*, 1945) *In French.*—In most organic crystals the intramolecular forces are greater than the intermolecular, and molecular movements can be divided into internal (movements of atoms within the molecule) and external (movement of the whole molecule). The external movements can be divided further into displacement of the centre of gravity, and changes of orientation. If, on proper choice of the unit cell, the centres of gravity form a simple lattice, their displacements are purely "acoustic," and lead only to Rayleigh scattering. The changes in orientation can be decomposed into three "pivotings," or simple harmonic oscillations about axes fixed in the molecule. For non-polar molecules plausible assumptions indicate that these axes coincide with the principal axes of inertia and with the axes of the refractivity ellipsoid. If this is a spheroid the molecule should rotate freely about the axis of revolution, but in real crystals free rotation takes place only if the distribution of optical electrons has an axis of symmetry. For polar molecules the axes coincide only in special cases. All external Raman frequencies in naphthalene and the dihalogen derivatives of benzene are due to pivotings. In benzene one is due to free rotation about the six-fold axis, the others to pivotings about axes perpendicular to this. A. J. C. W.

548.73 : 669.526.777 : 538.245 *see Abstr.* 2638

548.734.4 2695

The determination of unit-cell dimensions from X-ray rotation photographs of a randomly oriented single crystal. TURNER-JONES, A., AND BUNN, C. W. *J. Sci. Instrum.*, **23**, 177–82 (*Aug.*, 1946).—A method of indexing the reflections is described. Using this method, it is possible to take an irregular fragment of a crystal of completely unknown crystallography, set it up on an ordinary X-ray rotation goniometer in any position, take two photographs, and deduce the unit cell and space-group from them. The method is an extension of the "tilted crystal" method of indexing X-ray photographs [Abstr. 468 (1944)]. It is based on the interpretation of two 90° oscillation photographs taken over the same angular range; the second photograph is taken after tilting the crystal through a small known angle. From these two photographs the co-ordinates in space of reciprocal lattice points with reference to the axial system of the goniometer can be obtained. It is then necessary to choose an appropriate reciprocal unit cell, having regard to the symmetries displayed by the reciprocal lattice and the normal crystallographic conventions. The procedure is described with reference to two examples—a monoclinic and an orthorhombic crystal.

548.735 2696

Orientation effect in powder photographs of graphite. NELSON, J. B., AND RILEY, D. P. *Phil. Mag.*, **36**, 711–14 (*Oct.*, 1945).—An experimental study was made of the 000*l* reflections, which generally consisted of two well-defined separate lines. None of the other reflections, e.g. $10\bar{1}0$, $10\bar{1}1$, $11\bar{2}0$, showed this effect. The doubling of the lines is due to a preferred orientation of crystals in the specimen. The *c* dimension was found accurately by an extrapolation method [Abstr. 2586 (1945)]. L. S. G.

548.735 2697

X-ray determination of order parameters in lattices showing order-disorder transitions. I. General theory. II. Experimental. MACGILLAVRY, C. H., AND STRIJK, B. *Physica, 's Grav.*, **11**, 369–90 (*Feb.*); **12**, 129–50 (*June*, 1946).—I. A general theory of X-ray diffraction of crystals showing order-disorder transitions is presented which gives the explanation of all characteristic effects. It is shown how the order parameters (neighbour order σ, long distance order s and parameters referring to any intermediate distance) can be determined directly from the X-ray intensities. II. The intensity distribution in the superstructure interference domains of a single crystal of $AuCu_3$ was measured. Its Fourier transform gives the order parameters as a function of the distance between atomic sites. The results of a special case—crystal insufficiently annealed below the critical temperature—are discussed.

GEOPHYSICS 55

55 : 519 *see Abstr.* 2440

550.341 2698

The seismic geometry of a volcano such as Ruapehu. JONES, W. M. *N.Z. J. Sci. Tech. B*, **27**, 317–29 (*Jan.*, 1946).—The problem of the location of the foci of seismic disturbances for a volcano of the size of Ruapehu is discussed. A group of hypothetical stations is used to consider the geometrical principles involved, the layout of stations for particular methods, and the bearings of instrumental performance and initial assumptions on the accuracy attainable. Remarks are made also on the problem of early location of incipient activity in the thermal region.

550.342 : 532.593 = 393 2699

On the relation between sea waves and microseisms. I–II. SCHOLTE, J. G. *Versl. Ned. Akad. Wet. Afd. Natuurk.*, **52** (*No.* 10) 669–83 (1943) *In Dutch.*—Rejecting current explanations of microseisms as being due to surf (Wiechert, Gutenberg) or to the reaction of surface waves on the sea bottom (Algué, Gherzi, Banerji, Lee), it is shown that any disturbance of the sea generates two systems of waves: (*a*) gravitational, surface waves, independent of compressibility, amplitude decreasing exponentially with depth; (*b*) compressional, independent of gravity, amplitude independent of depth (cf. depth-sounding). Assuming constant depth of the ocean, infinite surface and elastic bottom, and neglecting viscosity, the equations of motion for free oscillations (no external pressure) are treated and the two wave solutions obtained. The case of normal periodic pressure is dealt with, the vibrations of the sea bottom are computed and it is shown that vibrations of the order of magnitude of recorded microseisms are possible. J. A. W.

550.385 : 523.755 *see Abstr.* 2453

551.41 = 393 2700

The distribution of continents and oceans on the surface of the earth. VENING MEINESZ, F. A. *Versl. Ned. Akad. Wet. Afd. Natuurk.*, **53** (*No.* 4) 151–9 (1944) *In Dutch.*—An explanation of the antipode situation of continents and oceans and the triangular shape of continents is sought in a theory of convection currents during the early period of cooling of the earth, 4 ascendant and 4 descendant. Each current occupied an octant and assuming that the axis of two of them coincided with the earth's axis, the distribution of the vertical component of the current is $w = -\frac{5}{2}C \sin\phi(\sin^2\phi - \frac{3}{5}) - \frac{1}{2}\sqrt{2}C\cos^3\phi\cos 3\lambda$, where ϕ = lat., λ = long., C = const. The distribution is shown in Mercator's projection. J. A. W.

551.46.018.9 : 771.319 2701

Photography of the ocean bottom. EWING, M., VINE, A., AND WORZEL, J. L. *J. Opt. Soc. Amer.*, **36**, 308–21 (*June*, 1946).—Discusses practical problems of design of apparatus for withstanding pressure, providing illumination, triggering the camera at the right time, etc. Attention is concentrated on photography of the actual bed of the ocean rather than intermediate strata of water. Illustrations include photographs at depths ranging to 1 950 ft and the apparatus has been used at depths from 12–2 400 ft. The biological, geological and oceanographic value of such photographs is indicated. N. C.

METEOROLOGY 551.5

551.508.11 : 537.591.08 *see Abstr.* 2624

551.510.41 : 539.167.3 *see Abstr.* 2663

551.510.535 : 621.396.11 : 621.396.821 : 537.568 2702

Geophysics of the ionosphere. COX, J. W. *Nature, Lond.*, **158**, 189–90 (*Aug.* 10, 1946).—A report of a discussion held by the Royal Astronomical Society. The subjects dealt with include: anomalous behaviour of the F_2 layer; correlation of vertical and horizontal angles of transmitted and received signals; forecasting of radiocommunication conditions from measurements of ionospheric reflexion coefficient and attenuation; solar and meteoric "noise"; fundamental processes of ionic recombination and attachment.

551.511 = 4 2703

Method of calculating the quantity of heat supplied to a column of air. BJORKDAL, E. *Met. Ann.*, **1** (*No.* 13) 357–76 (1943) *In French.*—The equation of local temperature variation is expressed in a form which exhibits the horizontal and vertical velocities of the air. The geostrophic wind is taken for the horizontal flow and the vertical flow is calculated from the equation of continuity. The column of air is that above the triangle Kajaani–Ilmala–Sloutzk and the calculation of the heat supplied is made from the radiosondes at these stations on April 2 and 3, 1939. Pressure and temperature gradients are found

from the scalar values. The average heat supplied was positive at all levels and amounted to 10^{-2} to 10^{-1} kW/ton. G. C. McV.

551.513.2 2704

Turbulence and diffusion in the lower atmosphere. FROST, R. *Proc. Roy. Soc. A*, **186**, 20–35 (*June* 4, 1946).—A semi-empirical expression is obtained for the virtual coefficient of diffusion, as a function of the height above the earth's surface, and this is used to obtain solutions of the equations of eddy diffusion and the equations of motion with given boundary conditions. These solutions are self-consistent and in good agreement with observations. The treatment is able to account quantitatively for such meteorological phenomena as the distribution of water vapour over land and sea (including evaporation from the oceans) and the diffusion of smoke near the ground. The discussion is confined mainly to an adiabatic atmosphere. L. S. G.

551.521 : 523.72 *see Abstr.* 2450

551.521.63 : 615.831.3 2705

Seasonal variations of ultra-violet energy in daylight. LUCKIESH, M., TAYLOR, A. H., AND KERR, G. P. *J. Franklin Inst.*, **238**, 1–8 (*July*, 1944).—Gives the results of six years' records at Cleveland, Ohio, of ultra-violet radiation received from the sun and sky and weighted in accordance with its effectiveness in producing sunburn. The average for each month, expressed as a percentage of the total for the year, is given for the whole period, together with records of sunshine and cloudiness. Curves are also given to show diurnal variation at three periods during the year. J. W. T. W.

551.524.33 : 523.746 2706

A remarkable 8-year period in air temperatures. TETRODE, P. *Proc. Ned. Akad. Wet.*, **45** (*No.* 4) 317–21 (1942).—Referring to earlier observations of coincidence between solar activity and Venus–Earth conjunctions, a relation between the synodic period (583·92 days) and earth temperature was sought. Five periods = 8 years (−2·3 days), and forming consecutive means over 160 years (8×20) for Zwarenburg, Prague and New Haven, and for the same stations plus Charleston and Batavia from 1852–1930 or 1939, an 8-year period is actually established. Tables and graphs are given. J. A. W.

551.571.7 2707

Notes on upper air hygrometry. II. On the humidity in the stratosphere. GLUCKAUF, E. *Quart. J. R. Met. Soc.*, **71**, 110–14 (*Jan.–April*, 1945).—The meteorograph records of the ascents, almost daily, over England during the months April 1939 and Sept. 1930 have been evaluated. The humidities so obtained indicate that (1) supersaturation with respect to ice is found very frequently in the upper troposphere; (2) within the stratosphere, dry air of a humidity mixing ratio of about 10^{-5} sometimes occurs, which can be explained only as tropical stratospheric air; and (3) on one occasion, very dry air from the stratosphere appears to have been drawn into the uppermost regions of the troposphere. R. S. R.

551.594.221 : 621.317.2 : 621.317.311 = 4 2708

Swiss lightning investigations: measurements carried out at Monte San Salvatore, near Lugano. BERGER, K. *Bull. Ass. Suisse Élect.*, **37**, 319–26 (*June* 15, 1946) *In French.*—[Abstr. 2322 B (1946)].

BIOLOGY 57/59

575 : 536.73 *see Abstr.* 2589

576.3 2709

A contribution to the mathematical biophysics of cell growth and shapes. I. RUNGE, R. *Bull. Math. Biophys.*, **7** (*No.* 4) 189–201 (*Dec.*, 1945).—The growth of a filopod is discussed under these conditions: (1) the growing cell-process is considered as a viscous thread approximately cylindrical; (2) interfacial tension forces at the interfaces of cell-process, culture medium and substrate fibre are predominant in causing elongation of the cell-process; (3) the volume of the cell-process remains constant during elongation. Equations of elongation and conditions ensuring elongation are derived both for the frictional and non-frictional types of motion of the cell-process. L. S. G.

576.8.095.14 : 541.14 2710

The effect of radiation on light emission by luminous bacteria. I and II. KLUYVER, A. J., VAN DER KERK, G. J. M., AND VAN DER BURG, A. *Proc. Ned. Akad. Wet.*, **45** (*No.* 9) 886–94; (*No.* 10) 962–7 (1942).—The reversible inhibition by radiation of bacterial luminescence here described was almost certainly due to a photochemical conversion of one of the components of the light-emitting system present in the bacteria. It remains questionable whether this conversion was due to a direct absorption of the light quanta by the component in question, or whether these quanta were absorbed by some other compound which acts as a photosensitizer. For the latter event, at first favoured by Harvey and his school [cf. *J. Gen. Physiol.*, **7**, 687, 679 (1925)], it has since been reported by them that riboflavin had probably acted as a photosensitizer in their experiments, but this idea has been rejected by the present authors, who support the first hypothesis from absorption spectra data of *Photobacterium phosphoreum.* H. H. HO.

576.8.098 : 532.61 *see Abstr.* 2513

577.1 : 537.312.5 : 539.13 *see Abstr.* 2352

577.15.033 : 532.61 *see Abstr.* 2512

578.088.5 : 537.542 : 539.16.08 *see Abstr.* 2654

591.185.5 : 534.321.9 *see Abstr.* 2532

MEDICAL SCIENCE . HUMAN PHYSIOLOGY 61

612.014.425 = 397 2711

Death by electric shock. GRÖNBERG, A., AND SÖDERBAUM, C. E. *Tekn. Tidskr.*, **76**, 341–54 (*April* 6, 1946) *In Swedish.*—The results of a series of resistance measurements on the human body are reported and shown in graphs. The measurements were taken between the hands, between hands and feet, and between the back and the hands, using 14 V d.c. or

2 V a.c. with electrodes of various sizes, wet or dry. The d.c. resistance is greater than the a.c. resistance, but the difference vanishes for large and for wet electrodes. The resistance decreases with time (2 800 Ω–2 150 Ω in 6 min) and is less when a person perspires. The values vary for different individuals (1 500 Ω–3 000 Ω), less so for wet electrodes. A certain capacitance effect seems to be present. The danger to life arises from heating (h.v.), effects on the nervous system, on the heart (50–100 V, 100 mA a.c.) or from muscular cramp (10–100 mA). Examples are described in detail, the literature is reviewed, shock treatment of mental disorders and first-aid measures are mentioned. J. A. W.

612.843.32 2712

Foveal colour sensitivity. THOMSON, L. C. *Nature, Lond.*, **157**, 805 (*June* 15, 1946).

612.843.35 = 5 2713

Time required to detect a contrast in coloured light. DEAGLIO, R., AND GEDDA, E. *Atti Accad. Torino*, **78** (*Tomo I*) 99–103 (1942–1943) *In Italian.*—It is found that at high brightnesses the minimum time is least at about 0·555 μ and increases towards the ends of the spectrum. Below a brightness of between 0·01 and 0·001 stilb (candle per cm²) the time increases rapidly and at very low brightnesses the curve connecting time with wavelength shows a minimum at about 0·58 μ. J. W. T. W.

612.843.35 : 612.845.5 : 535.642.1 *see Abstr.* 2316

612.843.4 2714

New entoptic phenomenon. JANSSEN, H. *Proc. K. Ned. Akad. Wet.*, **49** (*No.* 4) 479–83 (1946).—When a light source is looked at through a small hole in a screen it is seen to have on each side a luminous extension, the whole forming a propeller shape. The author has tried the effect of various head movements on the apparent position of this "propeller" and concludes that it is formed by the aqueous humour. J. W. T. W.

612.845.5 : 612.843.35 : 535.642.1 *see Abstr.* 2316

615.831.3 : 551.521.63 *see Abstr.* 2705

615.831.7 : 535.247.4 : 551.521.63 *see Abstr.* 2415

615.849 : 621.386.1 2715

An X-ray apparatus for contact therapy. HAZEU, J. A. G., LEDEBOER, J. M., AND V. D. TUUK, J. H. *Philips Tech. Rev.*, **8**, 8–15 (*Jan.*, 1946).—[Abstr. 2115 B (1946)].

615.849 : 621.386.8 : 537.531.08 *see Abstr.* 2614

615.849.7 2716

A new method of making radon ointment. CARDENAS, ..., AND WEATHERWAX, J. L. *Radiology*, **46**, 381–4. (*April*, 1946).—On exposure to air of radon ointment prepared by the previous method of agitating lanolin in the presence of radon, the radiation intensity falls rapidly and there is a limit possible of concentration. A new method was derived in which the adsorptive properties of degassed charcoal is utilized to retain the gas to an efficiency approaching nearly 100%. Details of the method used, together with the apparatus employed, are given, this adsorptive method being superior to the emollient method. B. J. L.

615.849.7 : 539.16 *see Abstr.* 2651

616–073.75 = 4 2717

Localization of intra-ocular foreign bodies. PORCHER, P., GIANTURCO, C., GILLES, E., AND BARBADAULT, J. *J. Radiol. Electrol.*, **27**, 1–10 (1946) *In French.*—Four new methods are described, arising out of extensive war-time experience. The first method is purely geometrical. The eye is radiographed simultaneously with two easily recognizable objects placed in a precisely known geometrical relationship to it. By repeating this process from another direction the 3-dimensional co-ordinates of the foreign body can be deduced. The second method makes use of the movements of the eye. This is radiographed whilst looking in a series of directions, determined by the position of a light source. A metal ring, radiographed at the same time as the eye, indicates the angular position of the eye and from the relation of ring and foreign body in the series of radiographs, the position of the latter can be deduced. The third method is an extension of the stereoscopic method. After taking an ordinary stereoscopic pair of radiographs, a cork sphere, surrounded by wire lines of longitude, is placed in the exact position previously occupied by the eye and radiographed on the same film. A fourth method involves the use of simple apparatus for obtaining radiographs in two planes at right angles. Though not so precise as the other methods, it has the advantage of simplicity and is useful in difficult cases. J. E. R.

616–073.75 = 4 2718

Application of the laws of radiological optics to tomography. TILLIER, H., AND POROT, J. *J. Radiol. Electrol.*, **27**, 32–35 (1946) *In French.*—The general laws relating to the projection of radiographic shadows are re-stated and analysed. Particular stress is laid on the law of tangential incidence, whereby the features in a radiograph correspond to the zone in which the ray is tangential to a surface in the object examined. The application of this law to tomography, the radiography of specified body planes, is examined. Not only must the plane to be examined be determined, but this plane must be orientated to ensure the tangential incidence of the rays on the features of interest. J. E. R.

616–073.75 : 620.179.152 : 778.33 *see Abstr.* 2723

666.24/.25 : 535.661.3 2719

Coloured glasses. IV. The colours produced by metals. WEYL, W. A. *J. Soc. Glass Tech.*, **29**, 289–389T (*Oct.*, 1945).—In the first part A of the paper, the author discusses general fundamental principles in 3 chapters: (1) Fundamentals concerning the relationship between metals and glass, which include the formation of metal atoms in glasses, the solubility of metals, the role of tin oxide in the formation of ruby glass, and that of stannous chloride for silver mirrors. (2) The crystallization of metals from the glass melt with discussion of nucleus formation, crystal growth, and the theory of coagulation. (3) The absorption of light by metals. The second part, B, of the paper deals with the specific effects of different metals in 5 chapters: (1) Gold in gold ruby glasses. (2) Silver. (3) The silver-staining of glasses.

(4) Copper in copper-ruby glasses (hematinone and copper aventurine). (5) The copper staining of glasses. Each chapter contains an historical introduction followed by the relevant physics and chemistry of the operations described. E.g. in A2, von Smoluchowski's equation is treated at length, and in B3 the base-exchange reaction is considered. The paper contains numerous diagrams and tables of data. [See Abstr. 339, 340 (1946)]. H. H. HO.

669.526.777 : 548.73 : 538.245 = 4 *see Abstr.* 2638

669.71 : 539.374 = 3 *see Abstr.* 2677

PHOTOGRAPHY 77

771.319 : 551.46.018.9 *see Abstr.* 2701

771.534 2720

Studies in the sensitivity of photographic materials. II. Effects on the shape of the characteristic curves of photographic emulsions. TRIVELLI, A. P. H. *J. Franklin Inst.*, **241**, 1–21 (*Jan.*, 1946).—[See Abstr. 356 (1946)]. Solarization is shown to be a high-intensity effect produced by incomplete development. From its disappearance on prolonged development it is deduced that development centres exist with different chances of initiating grain reduction. The number of developed grains is proportional to the density. Sensitizing increases the number of developed grains, and its effect diminishes with prolonged exposures. Comparison of the characteristic curves of a sensitized and an unsensitized emulsion suggests the existence of different kinds of sensitivity specks, each of qualitatively different effect. A. HU.

771.534 2721

Studies in the sensitivity of photographic materials. III. Intrinsic sensitivity. TRIVELLI, A. P. H. *J. Franklin Inst.*, **241**, 85–96 (*Feb.*, 1946).—The dual nature of sensitivity, which involves the concepts of inertia and contrast, is shown by the fact that the same sensitizer may increase the intrinsic sensitivity and increase the quantum number simultaneously. The intrinsic sensitivity is a directly measurable pure number much smaller than the absorption coefficient of the grain, so that only a small part of the absorbed quanta is used for latent-image formation. Since similar AgBr grains exposed to X-rays show sensitivity differences, it is concluded that sensitivity is interlocked with the discrete structure of the incident radiation. Grain clumping may or may not produce contagious developability according to the developer used. A. HU.

771.534 2722

Studies in the sensitivity of photographic materials. IV. A tentative explanation of the intrinsic sensitivity. TRIVELLI, A. P. H. *J. Franklin Inst.*, **241**, 315–22 (*May*, 1946).—[See Abstr. 2721 (1946)]. The proportion of grains rendered developable by a given exposure is plotted against exposure for grain sizes between 0·12 and 0·7 μ^2. The resulting curves are congruent, indicating that each grain of a simple emulsion requires the same number of effective quanta to render it developable. The intrinsic sensitivity, however, increases with grain size. The concentration speck hypothesis is invoked to account for the fact that the number of effective quanta is no more than a fraction of the quanta absorbed, depending on the number and distribution of sensitivity specks on the grain. A. HU.

778.33 : 620.179.152 : 539.163 *see Abstr.* 2659

778.33 : 620.179.152 : 616–073.75 2723

Blurring in radiography. NEMET, A., COX, W. F., AND WALKER, G. B. *Brit. J. Radiol.*, **19**, 257–71 (*July*, 1946).—The four types of blurring found in radiography have been examined experimentally. Density curves of a sharp edge radiographed under various conditions are obtained, and the densities converted into radiation exposures. Film blurring is found to be negligible. Geometrical and motional blurring both result in a linear drop of energy received by the film across the blurred edge, though some deviation from this may result if there is non-uniform distribution of radiation across the X-ray tube focus. In the case of screen blurring the energy incidence is found to fall exponentially across the blurred edge, and an empirical formula is deduced. The constants in this formula for a number of types of screen have been determined. Mathematical expressions are derived for the energy distribution in combinations of the various types of blurring, which agree well with experiment. The problem of a quantitative method of specifying the amount of blurring is discussed, and the area under one-half of the energy distribution curve from a sharp edge is suggested as a suitable criterion. This is compared with methods suggested by other writers. J. E. R.

778.333 : 535.371 *see Abstr.* 2569